# CITY OF LODI

# COUNCIL COMMUNICATION

AGENDA TITLE: Set Public Hearing for March 5, 2003, to Consider Adopting a Resolution to Approve City of Lodi's Stormwater Management Program (SMP) as Prepared by Black & Veatch Corporation and Authorizing the City Manager to Approve Submittal of a Notice of Intent (NOI) to Apply for the National Pollutant Discharge Elimination System (NPDES) Phase II Permit Application to the Regional Water Quality Control Board (RWQCB)

MEETING DATE: February 5, 2003

PREPARED BY: *Public Works Director*

---

RECOMMENDED ACTION: That the City Council set a Public Hearing for March 5, 2003, to consider adopting a resolution to approve City of Lodi's Stormwater Management Program (SMP) as prepared by Black & Veatch Corporation and authorizing the City Manager to approve submittal of a Notice of Intent (NOI) to apply for the National Pollutant Discharge Elimination System (NPDES) Phase II Permit Application to the Regional Water Quality Control Board (RWQCB).

BACKGROUND INFORMATION: The State of California Water Resources Control Board, in compliance with Federal mandates, will require the City of Lodi, as well as other cities and entities, plus construction sites disturbing one or more acres, to obtain NPDES Phase II Stormwater permits by March 10, 2003. The current application cost is $7,500, which is also the annual permit cost for populations between 50,000 and 74,999.

Under the jurisdiction of the Central Valley Regional Water Quality Control Board, the State has developed a general stormwater permit. The City intends to apply for the permit and will have five years to implement a stormwater program that will meet general Phase II requirements. Background on these requirements was presented to Council at the March 26, 2002, Shirtsleeve Session.

The City has hired Black & Veatch Corporation as a consultant to assist the City with the preparation of a Stormwater Management Program (attached) and other documentation necessary for obtaining an NPDES Phase II permit. They have been working with the City on this project since May 2002. As intended and previously stated in the March 20, 2002, Council Communication, the City worked with Black & Veatch in utilizing existing materials for completion of this work. Black & Veatch has completed the necessary tasks listed below:

1. Summary of existing system, maintenance practices, and municipal code
2. Determine RWQCB requirements and prepare written summary
3. Facilitate establishing goals and objectives
4. Prepare Stormwater Management Program
5. Prepare NPDES permit Notice of Intent and related forms
6. Estimate cost of stormwater management activities and five-year implementation.
   - Details can be found on pages 11-41 through 11-43 under the Program Cost Summary section of the City's Stormwater Management Program (attached).

APPROVED: _____
~~H. Dixon Flynn~~ -- City Manager

Black & Veatch has also assisted in the development of the City's Best Management Practices (BMP). Found in the appendix of the SMP, these practices have been developed to assist the City in maintaining our Stormwater Management Program and can be used as a source of information. Although having the BMP in place is required by the RWQCB, the suggested practices are not mandatory and are provided as optional guidelines when dealing with and managing stormwater issues. City staff will develop a Stormwater Team that will be responsible for updating these practices by improving development standards and by improving our own construction specifications. Since specific practices are not mandatory, the BMP will be reviewed and/or edited as needed due to technology changes and according to the effectiveness of each practice while managing the City's stormwater program.

California's implementation of the Federal requirements has been delayed due to a recent Federal Court decision. One of the issues was the lack of required public input in adopting the SMP. Thus, staff is recommending a public hearing on this item.

| | | | |
|---|---|---|---|
| FUNDING: | Budgeted Fund: | Wastewater Fund | $7,500 |
| | Operating Budget: | 2002/03 fiscal year | |

FUNDING AVAILABLE: _____
Vickie McAthie, Finance Director

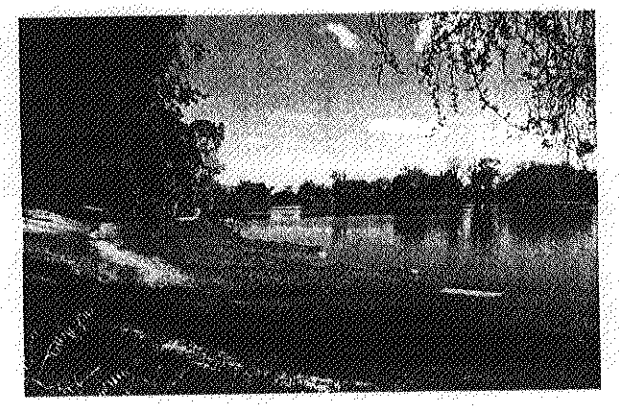
Richard C. Prima, Jr.
Public Works Director

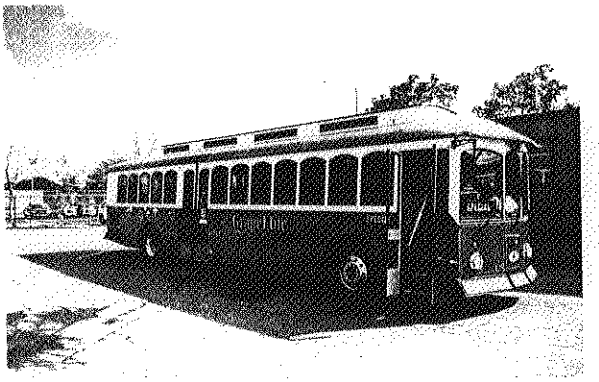
Prepared by Marlinda C. Devera, Management Analyst
RCP/MD/dsg
Attachment

cc: Randy Hays, City Attorney
F. Wally Sandelin, City Engineer
Fran E. Forkas, Water/Wastewater Superintendent
George M. Bradley, Street Superintendent
Curt Juran, Streets Contract Administrator
Marlinda Devera, Management Analyst
Black & Veatch Corporation
Concerned Parties

CITY OF LODI

# STORMWATER MANAGEMENT PROGRAM





Prepared by

BLACK & VEATCH
Corporation

January 2003

# TABLE OF CONTENTS

# TABLE OF FIGURES



# TABLE OF TABLES

# 1. Executive Summary

Phase II of the National Pollutant Discharge Elimination System (NPDES) requires the City of Lodi, and all other small municipal separate storm sewer systems (MS4s) to obtain a permit for storm water discharges. The City is required to develop and implement a Stormwater Management Program (SMP) that describes best management practices (BMPs), measurable goals, and timetables for implementation in six program areas: public education and outreach, illicit discharge detection and elimination, public participation/involvement, construction site runoff control, post-construction runoff control, and pollution prevention/good housekeeping. Additionally, the MS4 must reduce its discharge of pollutants to the Maximum Extent Practicable (MEP) and perform inspections and monitoring. The following document is the City's SMP.

The BMPs chosen were determined through a series of meetings, both public and internal. Initially, City Staff met with Black & Veatch to discuss issues and project goals. Black & Veatch then developed a series of BMPs which initially were presented to staff and then to the general populous at a public meeting. No public comments were received following the meeting, and the SMP was finalized.

Table 1-1 relates key BMPs the City has chosen to implement and the pollutants they will be designed to address. The pollutant load reductions resulting from BMP implementation will help ensure that the City meets NPDES requirements and that the Mokelumne River water will be a protected source, suitable for drinking water supply for years to come.

## Table 1-1 - City of Lodi BMPs and Pollutants Addressed

| City of Lodi BMP | Category of Pollutant Addressed | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Nutrients | Sediments | Organic Materials | *Pathogens* | *Hydrocarbons* | *Metals* | Synthetic Chemicals | Chlorides | Trash and Debris |
| BMP Inspection & Maintenance | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Classroom Education | ✓ | ✓ | | | ✓ | | ✓ | | ✓ |
| Community Car Washing | ✓ | | | | ✓ | | | | |
| Community Educational Efforts | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Community Hotline | | | | | ✓ | ✓ | ✓ | | ✓ |
| Contractor/Inspector Training | | ✓ | | | | | | | ✓ |
| Detention Ponds | | ✓ | ✓ | | | | | | ✓ |
| Disposal of Chlorinated Water | | | | | | | ✓ | ✓ | |
| Erosion Control for Construction | ✓ | ✓ | | | ✓ | | | | ✓ |
| Floatable Debris Control Program | | | | | ✓ | | | | ✓ |
| Grass-lined Swale | ✓ | ✓ | ✓ | ✓ | | | | | |
| Illicit Discharge Detection & Control Programs | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Inlet/Outlet Protection | | ✓ | | | | | | | |
| Lodi Municipal Code | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Storm Drain Cleaning | | ✓ | | ✓ | | | | | ✓ |
| Storm Drain Detectives | ✓ | ✓ | ✓ | | | | | | ✓ |
| Street Cleaning | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |
| Urban Forestry | ✓ | ✓ | | | | | | | |

Details of the BMPs and instructions on their implementation can be found in Appendix A to this report. Table 1-2 is a brief description of the BMPs.

**Table 1-2 - General BMP Description**

| BMP | Discussion |
|---|---|
| BMP Inspection and Maintenance | BMP inspection is necessary to ensure BMPs are in proper working order. Generally, inspection and maintenance of BMPs can be categorized into two groups: expected routine maintenance and nonroutine (repair) maintenance. |
| Classroom Education | The classroom education BMP involves a variety of activities to promote stormwater awareness in local classrooms. |
| Community Car Washing | This practice involves educating the public, businesses, and municipal fleets regarding the water quality impacts of the outdoor washing of automobiles and how to avoid allowing polluted runoff to enter the storm drain system. The City has chosen to pay special attention to the potential impacts of fundraising type carwashes. |
| Community Educational Efforts | Community education is key to the success of the Plan. The program will address this BMP through a variety of means including pamphlets, local media, mailers, and classroom contact. |
| Community Hotline | Community hotlines provide a means for concerned citizens and agencies to contact the appropriate authority when they see water quality problems. |
| Contractor / Inspector Training | Ensuring that contractors and inspectors are properly trained is key to proper BMP implementation. Contractor training can be accomplished through municipally-sponsored training courses, or more informally through mandatory preconstruction or prewintering meetings and regular and final inspection visits to transfer information to contractors. |
| Detention Ponds | This BMP will ensure that the City continues to use existing detention basins in their stormwater protection strategy. |
| Disposal of Chlorinated Water | Chlorinated water discharged to surface waters has an adverse impact on local water quality. Proper disposal of chlorinated water can include dechlorination before discharge and/or discharge to the sanitary sewer system. |
| Erosion Control for Construction | Erosion control for construction will be approached through a variety of mechanisms including construction entrances, tire wash facilities, outlet protection, check dams, sediment barriers, inlet protection, and concrete washouts. |
| Floatable Debris Control Program | Floatable debris represents a significant source of pollution within the City. The City will begin by identifying the sources of floatable material in stormwater. The program will then be expanded to control the amount of material in the outflow of the system. |
| Grass-lined Swale | Grass-lined swales are a series of vegetated, open channels designed specifically to treat and attenuate stormwater runoff for a specified water quality volume. |
| Illicit Discharge Detection and Control Programs | The objective of an illicit discharge investigation program is to identify and eliminate the discharge of pollutants to the stormwater drainage system. Controlling illicit discharges provides important public health benefits as well as ecosystem protection. |
| Inlet/Outlet Protection | This BMP helps ensure pollutants will be stopped from entering the stormwater system and the natural environment. |
| Lodi Municipal Code | The current sections of the Lodi Municipal Code do not adequately address the Phase II requirements. For that reason substantial changes to the Code will be required. |
| Storm Drain Cleaning | Storm drain systems need to be cleaned regularly in order to maintain their ability to trap sediment and prevent flooding. |
| Storm Drain Detectives | Storm Drain Detectives is a collaborative effort of the City of Lodi Public Works Department, State Water Resources Control Board-Division of Water Quality, Lodi Lake Nature Area Docent Council, and four local high schools. Monthly monitoring of nine locations along the Mokelumne River and Lodi Lake is done trained volunteers. |
| Street Cleaning | This management practice involves employing pavement cleaning practices such as street sweeping on a regular basis to minimize pollutant export to receiving streams. |
| Urban Forestry | Urban forestry is the practice of establishing and maintaining trees and forests in and around towns and cities. Since trees absorb water, patches of forest and the trees that line streets can help provide some of the stormwater management required in an urban setting. |

Specific BMPs and the Phase II NPDES requirements they fulfill are shown in Table 1-3.

**Table 1-3 – NPDES Phase II Category-Specific BMPs**

| | NPDES Phase II Program Categories | | | | | |
|---|---|---|---|---|---|---|
| | **Public Education and Outreach** | **Public Participation/ Involvement** | **Illicit Discharge Detection and Elimination** | **Construction Site Runoff Control** | **Post-Construction Runoff Control** | **Pollution Prevention/ Good Housekeeping** |
| Lodi All Emergency Preparedness Expo | X | X | | | | |
| Storm Drain Detectives | X | X | X | | | X |
| Storm Drain Labeling | X | X | X | | | X |
| Detention Ponds | | | | | X | X |
| City Design Standards | | | | X | X | |
| Mokelumne River Watershed Owner's Manual | X | X | | | | X |
| BMP Inspection and Maintenance | | | X | X | X | X |
| Check Dam | | | | X | | |
| Classroom Education | X | X | | | | |
| Community Car Washing | X | X | | | | X |
| Community Hotline | X | X | X | | | |
| Concrete Washout | | | | X | | |
| Construction Entrance | | | | X | | |
| Contractor/Inspector Training | | | | X | | |
| Disposal of Chlorinated Water | | | X | | | X |
| Dry Extended Detention Pond | | | | | X | X |
| Educational Pamphlets | X | X | X | | | X |
| Floatable Debris Control | | X | | | X | X |
| Grass-lined Swale | | | | | X | X |
| Illicit Discharge Programs | | X | X | | | |
| Inlet/Outlet Protection | X | X | X | X | X | X |
| Ordinance | X | X | X | X | X | X |
| Sand or Biofilter Bag Sediment Barriers | | | | X | | |
| Storm Drain Cleaning | | | | | | X |
| Straw Bale or Roll Sediment Barriers | | | | X | | |
| Street Cleaning | | | | | | X |
| Tire Wash Facility | | | | X | | |
| Stormwater Quality Video | X | X | | | | X |
| Urban Forestry | | | | | X | |

# 2. Report Organization

This report is organized as follows:

- Executive Summary
- Report Organization
- Introduction
- Phase II NPDES Permit Requirements
- Description of Existing Stormwater Drainage and Collection Systems
- Conveyance System Operations and Maintenance Procedures
- Budget Information
- Current Best Management Practices
- Lodi Stormwater Management Challenges
- Stormwater Management Program Elements
- Program Cost Summary

# 3. Introduction

The passage of the Clean Water Act (CWA) in 1972 has led to dramatic increases in the water quality of the Nation's streams and rivers; however, degraded water bodies still exist. According to the 1996 United States Environmental Protection Agency National Water Quality Inventory, approximately 40 percent of the U.S. waters surveyed are considered to be impaired by at least one of a wide variety of pollutants. Stormwater runoff represents a significant source of this contamination. Table 3-1 summarizes the pollutants commonly found in stormwater, their sources, and potential impacts.

**Table 3-1 - Common stormwater pollutants, sources, and possible impacts**

| Pollutants | Common Sources | Possible Impacts |
|---|---|---|
| Nutrients: Nitrogen, Phosphorus | Animal waste, fertilizers, failing septic systems, atmospheric deposition, vehicular deposition | Algal growth, reduced clarity, other problems associated with eutrophication (oxygen deficits, release of nutrients and metals from sediments) |
| Sediments: Suspended in water column and deposited on bottom of water body | Construction sites, other disturbed and/or non-vegetated lands, eroding banks, road sand | Increased turbidity, reduced clarity, lower dissolved oxygen, deposition of sediments, smothering of aquatic habitats including spawning sites |
| Organic Materials | Leaves, grass clippings | Oxygen deficit in receiving waters, fish kills, turbidity |
| Pathogens: Bacteria and Viruses | Animal waste, failing septic systems, dumpsters | Human health risks associated with drinking supply, consumption of affected shellfish, and swimming beach contamination |
| Hydrocarbons: Oil and Grease, PAHs such as Napthalenes & Pyrenes | Industrial processes, automobile wear, emissions and fluid leaks, waste oil | Toxicity of water column and sediment, bioaccumulation through the food chain |
| Metals: Lead, Copper, Cadmium, Zinc, Mercury Chromium, Aluminum, others | Industrial processes, normal wear of auto brake linings and tires, automobile emissions and fluid leaks, metal roofs | Toxicity of water column and sediment, bioaccumulation in aquatic species and through the food chain, fish kills |
| Synthetic Chemicals: PCBs, Pesticides | Pesticides (herbicides, insecticides, fungicides, rodenticides), industrial processes | Toxicity of water column and sediment bioaccumulation through the food chain, fish kills |
| Chlorides | Leaching from naturally occurring sources, septic tanks, fertilizers, and pesticides | Toxicity of water column and sediment |
| Trash and Debris | Litter washed through storm drain networks, commercial parking lots adjacent to surface water, overflowing | Degradation of surface water aesthetics, threat to wildlife |

**Source: Adapted from Minnesota Urban Small Sites BMP Manual**

The Mokelumne River drains a portion of the central western slope of the Sierra Nevada Mountains to the Sacramento Delta and serves as a source of water supply for a large portion of Northern California. The City drainage system is bounded by the Mokelumne River on the North; Harney Lane on the South; the CCT Railroad, Kettleman Lane and Highway 99 on the East; and the Woodbridge Irrigation District (WID) Canal and approximately 2,600 feet west of Sacramento Road on the West. The drainage area totals approximately 6,673 acres (10.4 sq. mi.). The population of the City is approximately 58,950.

As part of the Environmental Protection Agency's (EPA's) Phase II National Pollutant Discharge Elimination System (NPDES) requirements, Black & Veatch completed a Phase II permit application for the City. This document is the City of Lodi Stormwater Management Program (SMP) that has developed from the permit application. The SMP has three objectives: to minimize the impact of stormwater drainage on the residents of Lodi, to minimize the negative impacts of receiving water quality of the Mokelumne River, and to minimize the negative impacts on the fish and wildlife habitat.

In order to accomplish these objectives, the SMP is designed to reduce the discharge of stormwater pollutants to the Maximum Extent Practicable (MEP), protect water quality, and satisfy the appropriate water quality requirements of the Clean Water Act. The SMP includes the development of BMPs in each of six categories, an implementation schedule, and measurable goals to help the City ensure that the water discharged is of the highest quality that is economically possible.

Pollutants are deposited on the ground surface through a variety of urban activities and transported to nearby rivers and streams during periods of rainfall. Common pollutants found in stormwater and addressed by best management practices (BMPs) include pesticides, herbicides, microbiological contaminants, sediments, nutrients, and heavy metals. The Phase II program also places special emphasis on the need to protect stormwater from the pollutants introduced through construction site runoff. In compliance with the NPDES Phase II program, the City chose to address the introduction of contaminants through six general BMP categories outlined in Section 4 of this report.

# 4. Phase II NPDES Permit Requirements

The Summaries of Regulatory Requirements in this section are based on Federal Law and Draft Waste Discharge Requirements from the California State Water Resources Control Board. Before the SMP is implemented, a review of the final California Phase II NPDES Program Requirements should be completed when they are published. Following the review, the SMP should be modified as necessary.

The City will complete an individual permit to fulfill Phase II requirements. Individual permits are designed to be used by those entities with specific, unique problems that cannot be effectively dealt with under a general permit. They are required for Phase I "medium" and "large" municipal separate storm sewer systems (MS4s), but are not recommended by the EPA for Phase II program implementation. The permitee can submit an individual application for coverage by either the Phase II MS4 program or the Phase I MS4 program. For individual coverage under Phase II, the permitee must follow Phase II permit application requirements and provide an estimate of square mileage served by the system and any additional information requested by the NPDES permitting authority.

Operators of regulated small MS4s are required to submit the following information in their NOI or individual permit application:

- BMPs must specifically address each of the six minimum control measures as shown in Table 4-1 below.
- Measurable goals must be established and listed in the application for each minimum control measure
- Estimated timeframe in which actions to implement each measure will be undertaken, including interim milestones and frequency must be given
- Name(s) of the person(s) responsible for implementing or coordinating the stormwater program must be included.

**Table 4-1 - NPDES Phase II Requirements**

| | |
|---|---|
| Public Education and Outreach | Distribute educational materials and perform outreach to inform citizens about the impacts polluted stormwater runoff discharges can have on water quality. |
| Public Participation/Involvement | Provide opportunities for citizens to participate in program development and implementation, including effectively publicizing public hearings and/or encouraging a citizen representative on a stormwater management panel. |
| Illicit Discharge Detection and Elimination | Develop and implement an ordinance making it illegal to convey non-stormwater discharges through the MS4, and prepare a plan to detect and eliminate illicit discharges to the storm sewer system (includes developing a system map and informing the community about hazards associated with illegal discharges and improper disposal of waste). |
| Construction Site Runoff Control | Develop, implement, and enforce an erosion and sediment control program for construction activities that disturb one or more acres of land. (Controls could include silt fences and temporary stormwater detention ponds.) |
| Post-Construction Runoff Control | Develop, implement, and enforce a program to address discharges of post-construction stormwater runoff from new development and redevelopment areas. Applicable controls could include preventive actions such as protecting sensitive areas (e.g., wetlands) or the use of structural BMPs such as grassed swales or porous pavement. |
| Pollution Prevention/Good Housekeeping | Develop and implement a program with the goal of preventing or reducing pollutant runoff from municipal operations. The program must include municipal staff training on pollution prevention measures and techniques (e.g., regular street sweeping, reduction in the use of pesticides or street salt, or frequent catch-basin cleaning). |

**Source: EPA Stormwater Phase II Final Rule Fact Sheet Series**

## 4.1. Discussion of Required BMPs

### *4.1.1. Public Education and Outreach*

An informed, knowledgeable community helps to ensure greater support and compliance and is crucial to the success of a stormwater management. It is noted that the summary of Regulatory Requirements is based on Federal Law and Draft Waste Discharge Requirements from the California State Water Resources Control Board. Before the program is implemented, a review of the final California Requirements should be completed.

#### *4.1.1.1. Summary of Regulatory Requirements*

The NPDES Phase II regulations require that the City implement a public education program to distribute educational materials to the community, or conduct equivalent outreach activities about the impacts of stormwater discharges on water bodies and steps the public can take to reduce pollutants in stormwater runoff.

### *4.1.2. Public Participation/Involvement*

The EPA states that the public can provide valuable input and assistance to a regulated small MS4s Municipal Stormwater Management Program, and suggests the public be given opportunities to play roles in developing and implementing the program. Additionally, the EPA states that an active and involved community is crucial to the success of a Stormwater

Management Program because it allows for broader public support, shorter implementation schedules, a broader base of expertise, economic benefits, and a conduit to other programs.

#### *4.1.2.1. Summary of Regulatory Requirements*

When implementing a public involvement/participation program, the City of Lodi must, at a minimum, comply with state, tribal, and local public notice requirements. The City must also must make copies of the General Permit and Stormwater Management Program available to the public for review.

### *4.1.3. Illicit Discharge Detection and Elimination*

Discharges from MS4s may frequently include wastes and wastewater from non-stormwater sources. Illicit discharges enter the system through either direct connections (e.g., wastewater piping either mistakenly or deliberately connected to the storm drain system) or indirect connections (e.g., infiltration into the MS4 from failed sanitary sewer systems, spills collected by drain outlets, or paint or used oil dumped directly into a drain). The result is untreated discharges that contribute high levels of pollutants, including heavy metals, toxics, oil and grease, solvents, nutrients, viruses, and bacteria to receiving waterbodies. EPA studies show pollutant levels from these illicit discharges are high enough to significantly degrade receiving water quality and threaten aquatic life, wildlife, and human health. It is important to note that limited data on the Mokelumne River indicates its water is relatively pure and minimally impacted by stormwater discharges.

#### *4.1.3.1. Summary of Regulatory Requirements*

To comply with NPDES Phase II program requirements, the City of Lodi must:

- Develop, implement, and enforce a program to detect and eliminate illicit discharges [as defined at Sec. 122.26(b)(2)] into the small MS4.
- If not already completed, develop a storm sewer system map, showing the location of all outfalls and the names and locations of all waters of the United States that receive discharges from those outfalls.
- To the extent allowable under state, tribal or local law, effectively prohibit, through ordinance, or other regulatory mechanism, non-stormwater discharges into the municipal storm sewer system and implement appropriate enforcement procedures and actions.
- Develop and implement a plan to detect and address non-stormwater discharges, including illegal dumping, to the MS4 system.
- Inform public employees, businesses, and the general public of hazards associated with illegal discharges to the MS4 and improper disposal of waste.
- The City needs to address the following categories of non-stormwater discharges or flows (i.e., illicit discharges) only if they represent significant contributors of pollutants to the small MS4: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration [as defined at 40 CFR 35.2005(20)], uncontaminated pumped ground water, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, dechlorinated swimming pool discharges, and street wash water.

(Discharges or flows from fire fighting activities are excluded from the effective prohibition against non-stormwater and need only be addressed where they are identified as significant sources of pollutants to waters of the United States.)

### 4.1.4. Construction Site Runoff Control

Polluted stormwater runoff from construction sites often flows to MS4s and is ultimately discharged into local rivers and streams. During a short period of time, construction sites can contribute more sediment to streams than can be deposited naturally during several decades. The resulting siltation and the contribution of other pollutants from construction sites, can cause physical, chemical, and biological harm to our nation's waters.

#### 4.1.4.1. Summary of Regulatory Requirements

- The City must develop, implement, and enforce a program to reduce pollutants in stormwater runoff to the MS4 from construction activities that result in a land disturbance of one acre or larger. Reduction of stormwater discharges from construction activity disturbing less than one acre must be included in the program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more.
- The program must include the development and implementation of, at a minimum:
  - An ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under state, tribal, or local law;
  - Requirements for construction site operators to implement appropriate erosion and sediment control (ESC) best management practices;
  - Requirements for construction site operators to control waste, such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste, at the construction site that may cause adverse impacts to water quality;
  - Procedures for site plan review which incorporate consideration of potential water quality impacts;
  - Procedures for receipt and consideration of information submitted by the public;
  - Procedures for site inspection and enforcement of control measures (grading permits);
  - A program to inspect construction sites and enforce actions against violators.

### 4.1.5. Post-Construction Runoff Control

Post-construction stormwater management is necessary in areas undergoing new development or redevelopment because runoff from these areas has been shown to significantly impact the quality of receiving waterbodies. Many studies indicate that prior planning and design for the minimization of pollutants in post-construction stormwater discharges is the most cost-effective approach to stormwater quality management.

#### 4.1.5.1. Summary of Regulatory Requirements

- The City must develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or

sale, that discharge into the MS4. The program must ensure that controls are in place that would prevent or minimize water quality impacts.

- The City must:
  - Develop and implement strategies which include a combination of structural and/or non-structural best management practices (BMPs) appropriate for the community;
  - Use an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under state, tribal or local law;
  - Ensure adequate long-term operation and maintenance of BMPs.

### 4.1.6. Pollution Prevention/Good Housekeeping

The Pollution Prevention/Good Housekeeping measure requires the City of Lodi to examine and subsequently alter their own actions to help ensure a reduction in the amount and type of pollution that: (1) collects on streets, parking lots, open spaces, and storage and vehicle maintenance areas and is discharged into local waterways; and (2) results from actions such as environmentally damaging land development and flood management practices or poor maintenance of storm sewer systems. This measure, while primarily meant to improve or protect receiving water quality, can also result in a cost savings for the City by encouraging proper and timely maintenance of storm sewer systems, which will help avoid repair costs from damage caused by deterioration and neglect.

#### 4.1.6.1. Summary of Regulatory Requirements

The City must develop and implement an operation and maintenance program that includes a training component which has the ultimate goal of preventing or reducing pollutant runoff from municipal operations. Using training materials that are available from the EPA, the State of California, or other organizations, the program must include employee training to prevent and reduce stormwater pollution from activities such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and stormwater system maintenance.

# 5. Description of Existing Stormwater Drainage and Collection System

## 5.1. City of Lodi

The City of Lodi is located in the San Joaquin Valley approximately 6.5 miles north of Stockton and 35 miles south of Sacramento, adjacent to U.S. Highway 99. It covers an area of 10.4 square miles, and as of January 2001, its population was 58,950. The City provides municipal and public utilities, transportation, leisure, cultural, social services, and general government services. Included in the City's municipal services are stormwater and flood control.

The City maintains an intricate, gravity-based stormwater system built around a number of stormwater detention basins and disposal of runoff by pumping to the Woodbridge Canal, Lodi Lake, or the Mokelumne River. The detention basins are scattered throughout the City and are maintained as parks and recreational facilities during non-runoff periods. The following describes the City's current stormwater system and serves as the basis for the Stormwater Management Program.

## 5.2. Catch Basins and Manholes

Table 5-1 shows the total number of catch basins and manholes in the City's stormwater system for the past four years. On average, 33 catch basins and 28 manholes are added to the system each year.

**Table 5-1 - City Catch Basins and Manholes**

| Year | Total Catch Basins | Total Manholes |
|---|---|---|
| 1999-00 | 2,650 | 1,515 |
| 2000-01 | 2,682 | 1,545 |
| 2001-02 | 2,710 | 1,575 |
| 2002-03 | 2,750 | 1,600 |

## 5.3. Outlets

The City's stormwater drainage system includes 18 storm outlets to the Mokelumne River, Lodi Lake, or the Woodbridge Irrigation District Canal. Table 5-2 and Figure 5-1 identify the outlets and their locations throughout the City.

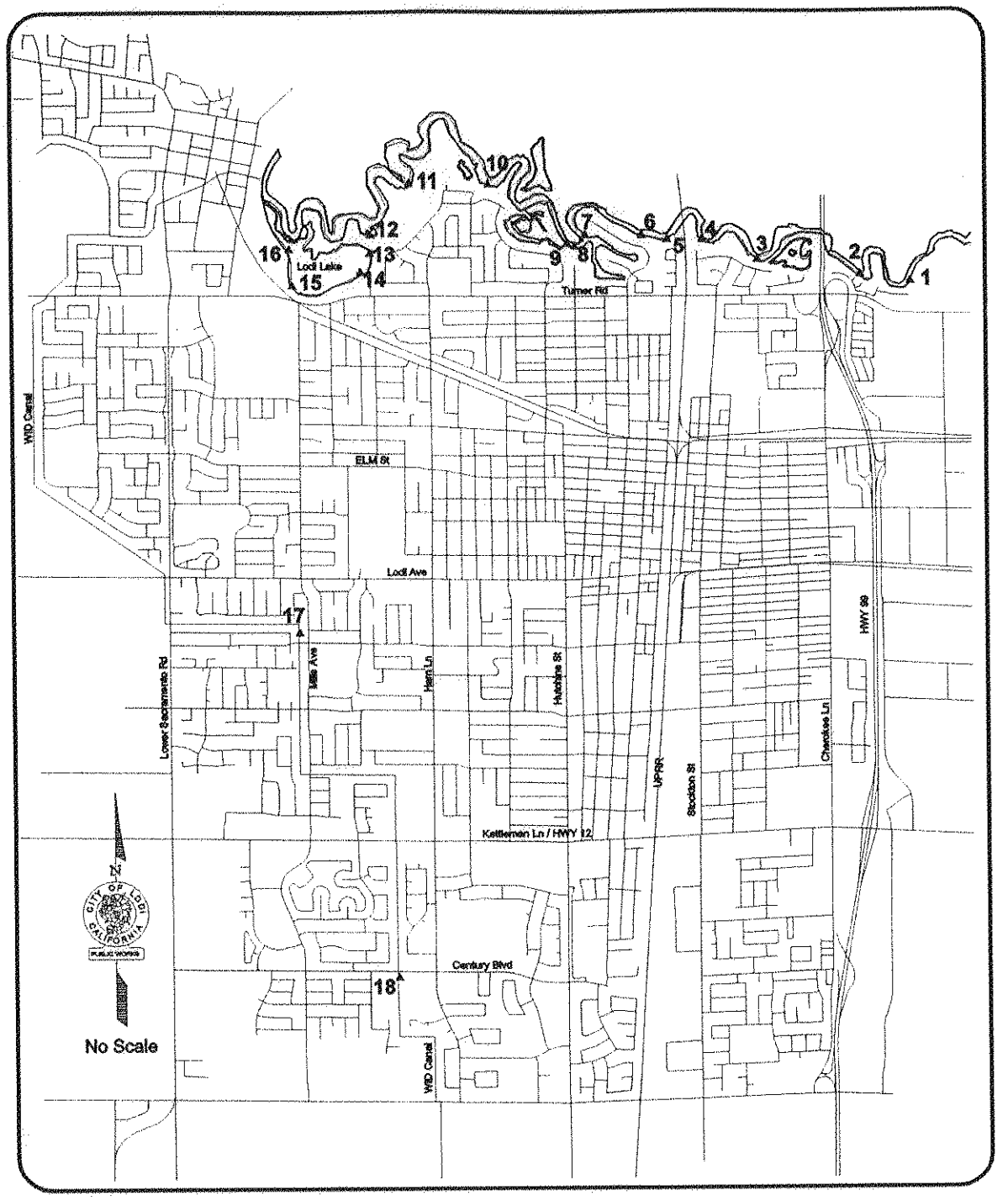



**Figure 5-1 - Outlet Locations**

**Table 5-2 - Outlet Location Description**

| Outfall No. | Location | Diameter (in) |
|---|---|---|
| 1 | Cluff Avenue (adjacent to Central Valley Waste) | 72 |
| 2 | Mobile Home Park | 30 |
| 3 | 317 Mokelumne River Drive | 48 |
| 4 | Awani Drive at Mokelumne River Drive | |
| 5 | Sacramento Street at River (Through RiverPointe Subdivision, #1872) | 24 |
| 6 | 1202 Rivergate Drive | 30 |
| 7 | 1335 Rivergate Drive | 12 |
| 8 | 1051 Lincoln | 30 |
| 9 | 1144 Edgewood Drive | 18 |
| 10 | 1610 Edgewood Drive | 21 |
| 11 | Ham Lane at Lodi Lake Wilderness | 36 |
| 12 | Pump Station at Wilderness | |
| 13 | Edgewood Drive at Lodi Lake | 21 |
| 14 | Laurel Avenue at Lodi Lake | 8 |
| 15 | Lodi Lake Pump Station at Mills Avenue | |
| 16 | Lodi Lake North of Pump Station | 54 |
| 17 | Shady Acres | |
| 18 | Beckman Pump Station, Century Boulevard at Ham Lane | 42 |

## 5.4. Detention Basins

Several stormwater detention basins are operated by the City to control runoff for events up to a 100-year storm. These detention basins also function as sports facilities (baseball fields, soccer fields, etc.), but their primary purpose is flood control. Table 5-3 summarizes the storm drain basins maintained by the City. A map of outlet locations is included in Appendix B.

**Table 5-3 - Storm Drain System Basin Data**

| Basin/Park | Tributary Area (acres) | Site Land Area (acres) | Detention Capacity (ac.ft.) |
|---|---|---|---|
| A-1, Kofu | *491* | *12*[1] | 41.5 |
| A-2, Beckman | 564 | 16.2[2] | 60.0 |
| B-1, Vinewood | 964 | 16.0 | 41.5 |
| B-2, Glaves[3] | 450 | 13.2 | 31.1 |
| *C, Pixley*[4] | *1,091* | *27.3* | *128.7* |
| D, Salas | 790 | 21.0 | 94.0 |
| E, Peterson | 340 | 20.9 | 61.0 |
| *F (at Kettleman)* | *369* | *30.0* | *68.5* |
| *F (near Tokay)* | | *30.0* | *68.5* |
| *G (DeBenedetti)* | *866* | *46.3* | *202.0* |
| H (Discharge to River) | 428 | | |
| *I (Undeveloped)* | 320 | *25.0* | |
| **Total** | **6,673** | **227.9** | **728.3** |

***Italics* indicate future or partially complete facilities. [1]Kofu acreage includes park south to tennis courts, excludes Municipal Service Center (MSC) & MSC parking. [2]Beckman acreage excludes Fire Station. [3]Glaves Park formerly Twin Oaks Park. [4]Pixley volume does not include 7 ac. ft. in Beckman Rd. ditch**

## 5.5. Pumping Stations

Lodi's stormwater system is serviced by 45 storm pumps operating at 14 pumping stations, as detailed in Table 5-4. All pumping stations are electrically-powered. Backup auxiliary power is supplied by on-site diesel emergency generators at Lodi Lake, Shady Acres and Beckman Park. The generator at Beckman Park is sized to run concurrently both a well and storm pump located onsite. The City also maintains a portable generator for emergency use.

**Table 5-4 - City of Lodi Stormwater Pumps**

| Station Name | Location | Pump No. | Horsepower | Installed |
|---|---|---|---|---|
| Salas Park | Near intersection of Century Boulevard and Stockton Street | 1, 2 | 14 | October 1983 |
| Cluff Avenue | Near intersection of Cluff Avenue and East Pine Street | 1, 2, 3, 4<br>5, 6 | 50<br>14 | November 1983<br>November 1983 |
| Kofu | 1300 Block of South Ham Lane | 1<br>2 | 7<br>20 | February 1969<br>February 1969 |
| Glaves | 2400 Block Oxford Way at Allen Drive | 1, 2 | 2 | May 1968 |
| Vinewood | 1824 West Tokay Street | 1<br>2, 3, 4 | 5<br>30 | February, 1983<br>January, 1970 |
| Lincoln | 1050 Lincoln Avenue | 1 | 20 | July, 1971 |
| Shady Acres | 358 Shady Acres | 1, 2, 3<br>4, 5 | 40<br>14 | March, 1985<br>March, 1985 |
| Beckman | 1300 Block of Century Boulevard at Woodbridge Canal | 1<br>2<br>3<br>4<br>5, 6<br>7, 8, 9 | 50<br>30<br>30<br>14<br>14<br>30 | October, 1973<br>September, 1975<br>October, 1975<br>October, 1983<br>November, 1989<br>November, 1989 |
| Lodi Lake | 2003 West Turner | 1<br>2<br>3, 4 | 35<br>50<br>50 | March, 1985<br>May, 1968<br>September, 1968 |
| Turner Road | Intersection of Turner Road and Railroad Underpass | 1, 2, 3, 4 | 2 | February, 1970 |
| Peterson | Intersection of Evergreen and Elm | 1, 2 | 14 | September, 1958 |
| Pixley | | 1, 2, 3 | 15 | Future |
| Wilderness | Lodi Lake | 1 | 5 | April, 1976 |
| Grape Bowl | Stockton | 1 | 5 | January, 1986 |

## 5.6. Pipe Conveyance

The City of Lodi maintains 110 miles of stormwater collection and conveyance piping. Lineal footages by pipe size are outlined in Table 5-5.

**Table 5-5 - Storm line lineal footages.**

| Pipe Diameter (in) | Length (ft) |
|---|---|
| 6 | 1,449 |
| 8 | 26,880 |
| 10 | 32,863 |
| 12 | 117,048 |
| 14 | 22,858 |
| 15 | 49,990 |
| 16 | 16,616 |
| 18 | 68,990 |
| 20 | 3,089 |
| 21 | 21,554 |
| 22 | 499 |
| 24 | 54,668 |
| 27 | 1,309 |
| 30 | 56,604 |
| 36 | 36,628 |
| 42 | 19,477 |
| 48 | 22,270 |
| 54 | 6,420 |
| 60 | 16,960 |
| 66 | 1,331 |
| 72 | 3,163 |
| **Total** | **580,666 ft**<br>**110 miles** |

**Updated 3-14-02**

## 5.7. Woodbridge Irrigation District Canal

The WID Canal is the receiving water for a significant portion of the City's stormwater. The Storm Drainage Discharge Agreement (Agreement) between the City and WID serves as the governing document between the two entities and allows the City to discharge stormwater into WID Canals for 40 years. The City is limited to discharging 160 cubic feet per second (cfs), as a maximum winter discharge rate. The maximum winter rate per discharge site is 60 cfs. During the summer WID uses the canal for irrigation purposes. Therefore, the City's discharge rate is reduced to a maximum of 40 cfs total, not to exceed 20 cfs per discharge site. This can be increased by giving WID notice 12 hours prior to discharge. Under the Agreement, the City has the right to modify the existing Beckman and Shady Acres Pump Stations and to construct additional discharge points to accommodate the service area.

On Tuesday, May 14, 2002 Black & Veatch met with Anders (Andy) Christensen, WID General Manager, to discuss any concerns regarding disposal into WID canals. Andy feels that as long as the City is able to meet future water quality requirements and does not exceed the maximum allowed flow, the Agreement will work well. Currently, he feels the main water quality problems appear to be nitrates, most likely from lawn fertilizers, and suspended solids. Evidence of the problem, including algal blooms below City outlets, can be found in the canals following pumping of the City's stormwater.

## 5.8. Capacity Issues

The City has experienced localized flooding in the past. The 1700 block of Lockeford Street has been a particularly troublesome area. Recent system improvements may have eliminated this problem. Residential streets southwest of Peterson Park have also been identified as areas that experiences occasional flooding due to undersized pipes. In general, operation of the system has shown that the City's stormwater pumps and detention basins are adequate for the runoff volume in the system. No system-wide modeling has been completed to confirm and predict operation of the system as it expands.

# 6. Conveyance System Operations and Maintenance Procedures

## 6.1. Personnel and Equipment

The City has 2.25 Full Time Equivalent (FTE) employees during normal periods. Following a storm event the City assigns a crew to patrol, clean and monitor each of six storm patrol districts.

The City maintains the following equipment for stormwater maintenance

- Backhoe
- Small Camera
- Loader
- Pickup trucks/cars
- Rodding truck
- Root cutter
- Sewer cleaner (2)
- Sweeper (2)
- Trucks
- Video Inspection Van

## 6.2. Inlets and Manholes

City stormwater system inlets and manholes are opened and inspected at least once annually. At the time of inspection, the manholes are cleaned and maintained/repaired as necessary.

## 6.3. Catch Basins

Stormwater catch basins are inspected and cleaned by hand annually. Liquid from the basins is decanted into the sanitary sewer, and solids are sent to the municipal wastewater treatment facility and ultimately to a landfill.

## 6.4. Pipelines

The City maintains approximately 110 miles of stormwater pipeline within the City. The City's maintenance plan includes cleaning of system storm pipes. In 1999-2000, the City cleaned approximately 30 miles of storm line. In 2000-2001, 2001-2002, and 2002-2003, the City cleaned 35, 40, and 40 miles of storm drain, respectively. Resulting from this plan, most pipes in the system are cleaned about every three years.

## 6.5. Outlets

Stormdrain outfalls are inspected annually. During the inspection, pictures detailing the condition of the outlet are taken, outlet and area conditions are noted, and maintenance recommendations are made.

## 6.6. Street Sweeping

Street sweeping is a regular maintenance activity performed by City employees. In March 2002, the City hired an additional maintenance worker and purchased a new sweeping truck for the purpose of increasing street sweeping frequency. As a result street sweeping frequency approximately doubled and is currently scheduled as follows: residential areas are swept twice per month, parking lots and alleys are swept once per month, the downtown area is swept three times per week, and major roadways are swept once per week. The City also uses a sidewalk sweeper to remove debris from the downtown area.

The City is developing a plan to deal with vehicles that hinder street sweeping. At present, when the City is unable to sweep an area due to vehicles in the street, notices are left on the vehicles. If the parked vehicles continue to be a problem, letters will be sent to local property owners. If the problem continues, temporary "No Parking" signs will be placed in the area, and vehicles blocking access will be towed.

Private property owners are required to sweep their parking lots weekly.

## 6.7. Pump Stations

The City does not have specified operations and maintenance procedures for the pump stations. Maintenance procedures depend on need. The City is not recording hours spent annually maintaining pump stations.

## 6.8. Detention Basins

The City does not have specified operations and maintenance procedures for detention basins. Cleaning after a storm depends on the amount of debris, damage and need.

# 7. Budget Information

## 7.1. Budget Procedures

The City's fiscal year begins July 1st of each year and ends on June 30th of the following year. The budgeting procedure begins prior to June 1 when the City Manager submits to the City Council a proposed two-year operating budget for the fiscal year commencing the following July 1. Following a series of public hearings, the budget is legally enacted through passage of a resolution prior to July 1.

## 7.2. Budget Summary

Table 7-1 is a summary of the 2001-2002 storm drain maintenance budget. The total storm drain maintenance budget for 2001-2002 was $264,455.

**Table 7-1 - 2001-2002 Storm Drain Maintenance Budget**

| Description | Budget |
|---|---|
| Salaries & Wages - Includes salary expenditures for Street Division personnel | $83,440 |
| Overtime - Includes salary expenditures for Street Division employees working after normal working hours on storm patrol and repairing malfunctioning storm pumps. | $4,500 |
| Incentive Pay - Includes expenditures for employees certified in various technical programs. | $1,200 |
| Overhead | $23,080 |
| Telephone - Includes expenditures for telephone lease lines used for monitoring eight existing storm drain pumping stations and a portion of the lease line used for answering service. | $5,000 |
| Electricity - Includes expenditures for electricity used by the City's 14 storm drain pumping stations, which have an accumulative total of 45 pumps. Projected electricity is based on last year's average projection. | $21,600 |
| Membership Dues - National stormwater associations. | $500 |
| Business Expense - Includes expenditures associated with attending seminars on development of the Phase II National Pollutant Discharge Elimination System permit. | $300 |
| Professional Services- Includes expenditures for Underground Service Alert and for sampling and testing stormwater discharges. | $1,000 |
| Repairs to Machinery & Equipment - Includes expenditures for the repair of storm drain pumps and panels | $11,700 |
| Sublet Service Contracts - Includes expenditures for cleaning the Woodbridge Irrigation District Canal at the Beckman and Shady Acres storm drain pumping stations, spraying the Beckman ditch by contract, and discing unimproved acreage by contract at Pixley and G storm drain basins. | $3,500 |
| Special Departmental Materials - Includes expenditures for miscellaneous materials required to maintain catch basin assemblies, replacement of manhole covers with vent type covers, paint for pump motors and panels, locks on gates to structures and panels, replacement hose augers for Vactor to flush and clean storm drain lines, manholes and catch basins, and sandbags. | $5,000 |
| Education & Training - Includes expenditures for education regarding stormwater regulations and the National Pollutant Discharge Elimination System | $4,000 |
| Small Tools and Equipment - Includes expenditures for rods and wrenches | $1,500 |
| Work by Others - Includes charges against the Storm System when other Divisions assist the Street Division. | $6,575 |
| Other Equipment - Includes expenditures to replace pumps and electronic equipment to maintain storm system. | $10,000 |
| Storm Drains - This function includes expenditures for repair of storm drain pump control systems. | $16,500 |
| Special Payments - Includes expenditures for payments to Woodbridge Irrigation District for discharge of storm drain pumping stations into the Woodbridge Irrigation Canal. | $65,060 |
| **Total** | **$264,455** |

# 8. Current Best Management Practices

Along with the normal operations and maintenance procedures outlined above, the City implements other Best Management Practices (BMPs) outlined in this section.

## 8.1. Lodi All Emergency Preparedness Expo

The City sponsors and participates in the Lodi All Emergency Preparedness Expo. The Expo is a free event featuring workshops and presentations from various safety and emergency response organizations. It is designed to increase public awareness on a variety of issues, including stormwater awareness.

## 8.2. Storm Drain Detectives

In October 2000, the City of Lodi's Public Works Department began a local Citizen Monitoring Program of the Mokelumne River, where the City's storm drains enter the river. The "Storm Drain Detectives" is a collaborative effort of the City of Lodi Public Works Department, State Water Resources Control Board-Division of Water Quality, Lodi Lake Nature Area Docent Council, and four local high schools. Monthly monitoring of nine locations along the Mokelumne River and Lodi Lake is done by students and teachers, grades 7-12, and other volunteers who have been trained by a program coordinator. Students are often given school credit for participating in this program. Funding for the program comes from the City of Lodi's, Public Works Department. Sampling locations, monitoring results, and other program details can be found on the City of Lodi's web site at www.lodi.gov.

The Storm Drain Detectives Program was established in part to defer a fine against the City's Wastewater Treatment Plant and was fully funded by the City. In previous years, it has not received funding from CALFED or any outside source. However, beginning in May 2002, partial funding will be provided by a CALFED grant. The City's portion of the funding is shown in Table 8-1.

**Table 8-1 - City of Lodi, Storm Drain Detectives Budget**

| | 2000-01 | 2001-02 | 2002-2003 | |
|---|---|---|---|---|
| | | | City Budget | CALFED Grant |
| Personnel Services | $6,000 | $7,000 | $7,000 | |
| Conference Expense | $225 | $300 | $300 | |
| Professional Services | $4,700 | $2,700 | $2,700 | |
| Special Department Materials | $9,000 | $3,000 | $3,000 | |
| **Total** | **$19,925** | **$13,000** | **$13,000** | **15,400** |

## 8.3. Facility Documentation

The City maintains a detailed storm sewer system map showing the location of all outfalls and the names and locations of all waters that receive discharges from those outfalls. City maps also show the locations and sizes of pipes, and locations of pump stations, manholes, and inlets.

## 8.4. Lodi Municipal Code

Stormwater protection is currently dealt with in Title 13 Chapter 12 of the Lodi Municipal Code. The Code does not adequately address the requirements of the Phase II program. For that reason the City must develop a new section of the ordinance, or a separate ordinance, that will address the following NPDES Phase II requirements:

Draft RWQCB requirements state that the City must:

- Adopt an ordinance, policy, or regulatory mechanism to prohibit non-stormwater[1] discharges into the storm sewer system and implement appropriate enforcement procedures and actions, including conducting manufacturing and commercial facility inspections, to the extent allowable under federal, state or local law.
- Adopt, maintain, and enforce an ordinance, policy, or other regulatory mechanism to require erosion and sediment controls at the construction sites, as well as sanctions to ensure compliance, to the extent allowable under federal, state or local law.
- Adopt and enforce an ordinance, policy, or other regulatory mechanism that requires projects include the incorporation, and long-term operation and maintenance of appropriate long-term BMPs.

## 8.5. Erosion Control for Construction

Developers are required to address erosion control within construction plan submittals. Typical measures required on plans include:

- Construction vehicle access control
- Temporary berms/sandbags
- Material stockpile locations
- Sweeping schedules
- Hay wattles

1 The Draft Waste Discharge Requirements from the California State Water Resources Control Board makes allowances for certain authorized non-stormwater discharges. Authorized non-stormwater discharges are certain categories of discharges that are not composed of stormwater but are not found to pose a threat to water quality. They include: water line flushing; landscape irrigation; diverted stream flows; rising groundwaters; uncontaminated groundwater infiltration (as defined in 40 CFR §35.2005(20)) to separate storm sewers; uncontaminated pumped ground water; discharges from potable water sources; foundation drains; air conditioning condensate; irrigation water that is not reclaimed treated wastewater; springs; water from crawl space pumps; footing drains; lawn watering that is not reclaimed treated wastewater; individual residential car washing; flows from riparian habitats and wetlands; dechlorinated swimming pool discharges; and discharges or flows from emergency fire fighting activities. It should be noted that the City must prohibit the above outlined discharges if they are found to cause or contribute to an exceedance of water quality standards or cause or threaten to cause a condition of nuisance or pollution.

- Installation and maintenance of catch basin filter screens
- Installation of front yard swales

During construction, the owner/developer is responsible for erosion control throughout the project. Typical provisions include:

- Removal of all sediment/soil deposited on existing paved roadways prior to leaving the work site, if possible, and in all cases within 24 hours.
- Plowing or ripping of all lot pads (rear of hinge line) prior to October 1 to a depth of 2 to 3 inches.
- Placement of "rock bags" at 200 to 300' intervals to isolate sediment prior to October 1 or threat of major rain prior to that date. Sediment to be removed weekly (or sooner, if large accumulation occurs or another storm is predicted).

## 8.6. Urban Forestry

Numerous environmental and stormwater benefits can be achieved through effective use of urban forestry. Trees can act as natural stormwater management areas by filtering particulate matter (pollutants, some nutrients, and sediment) and by adsorption of water. Urban forestry also reduces noise levels, provides recreational benefits, increases property values, and has been shown to reduce petty crime and vandalism rates.

The City of Lodi Public Works Department attempts to maintain and protect trees. The City is in the process of developing an Urban Forest Management Plan to assess the present condition of the urban forest, provide cost projections for future maintenance, assist with the budget process, and project and monitor changes in the forest over time. Not including those associated with Capital projects, the City plants approximately 250 trees a year and removes between 30 and 100 trees.

The City has submitted an application to be included in the Tree City USA program. The program requires the City to establish a Tree Board or Department, a Tree Care Ordinance, a Community Forestry Program with an annual budget of at least $2 per capita, and an Arbor Day Observance and Proclamation.

## 8.7. Mokelumne River Watershed Owner's Manual

The Mokelumne River Watershed Owner's Manual was developed by the Lower Mokelumne River Watershed Stewardship Plan Steering Committee to educate the public on the impacts of non-point sources of pollution on the River. The manual identifies common sources of pollution and outlines strategies that homeowners can take to minimize their impact. Chapters include: "Stormwater Management", "Household Wastewater", "Managing Household Hazardous Products", and "Yard and Garden Care".

## 8.8. Storm Drain Labeling

Through an Eagle Scout project, about 60% of the existing storm drain catch basins were labeled with placards indicating that water is discharged to the river and no dumping is allowed. Newly installed catch basins include placards.

## 8.9. Storm Drain Outlets

The City maintains an up-to-date map showing the location of all outfalls and the names and locations of all waters of the United States that receive discharges from those outfalls. The map is included in Appendix B of this report.

## 8.10. Heritage Primary School Clean-Up

October 28, 2002 is a Lodi Unified School District track change day which presents a problem for 9 teachers of 200 students who do not have available classroom space. On the day, students and teachers will work with the City to clean gutters in the area around the school. Each class will "adopt" a one square block area, cleaning up gutters and installing new storm drain labels if necessary. Garbage will be sorted, surveyed and disposed of at the school site. During the survey, door hangers will be distributed to inform the public of the importance of keeping the City clean. The City hopes to continue a similar program in future years.

# 9. Lodi Stormwater Management Challenges

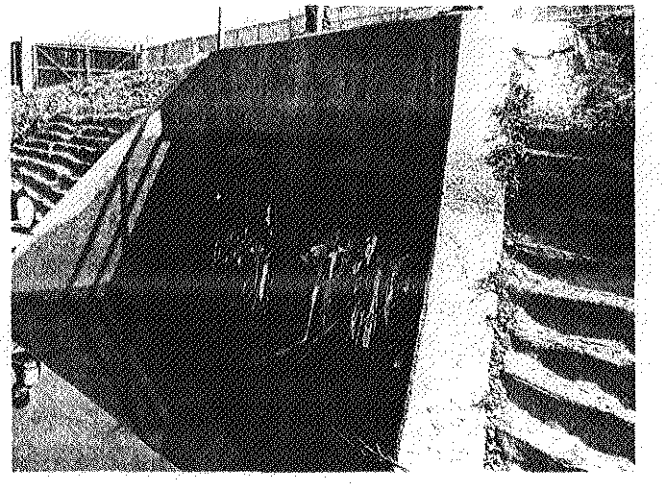
## 9.1. Construction Sites

The City's erosion control requirements are extremely developer-friendly, requiring only a small level of effort relative to other comparable cities. However, the City's construction standards are not adequate to meet the requirements of the Phase II program. Current City erosion control requirements are minimal, designed mainly to deal with the public nuisance caused by sediment rather than protect receiving water. Phase II NPDES permit requirements will require the City to develop a much more comprehensive erosion control management plan. The City must find a way to implement the requirements of the new program in a manner that not only meets NPDES requirements, but also continues to meet the City's development goals.

The Draft Waste Discharge Requirements for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems, issued July 12, 2002 by the California State Water Resources Control Board, outlines the requirements the City must follow. The guidance requires the City to develop, implement, and enforce a program to ensure controls are in place that will prevent or minimize water quality impacts from stormwater runoff from construction sites. Within the permit area, the program must apply to all construction projects that disturb greater than or equal to one acre (including projects less than one acre that are part of a larger common plan of development or sale that would disturb more than one acre) and that discharges into the City's Small MS4. At a minimum, the City must:

1. Adopt, maintain, and enforce an ordinance, policy, or regulatory mechanism to require erosion and sediment controls at the construction sites, as well as sanctions to ensure compliance, to the extent allowable under federal, state or local law;
2. Require construction site operators to implement appropriate and effective erosion and sediment control BMPs that utilize Best Available Technology (BAT) economically achievable and the Best Conventional Pollutant Control Technology (BCT) to reduce or eliminate stormwater pollution;
3. Require construction site operators to control all pollutant sources at the construction site that may cause adverse impacts to water quality including, but not limited to, construction materials waste, discarded building materials, concrete truck washout, chemicals, fuel, litter, and sanitary waste;
4. Implement procedures for pre-construction site plan and BMP review that incorporate consideration of potential water quality impacts from construction activities;
5. Implement procedures for receipt of and response to information submitted by the public regarding stormwater runoff impacts due to construction projects; and
6. Implement procedures for site inspections and enforcement of control measures.

## 9.2. Floatable Debris



Control of floatable debris in stormwater has been identified as one of the areas on which the City would like to focus its efforts. Floatable debris comes from a variety of sources and can cause a variety of problems, such as lowered efficiency and hydraulic capacity, aesthetic degradation of waterways, possible toxic effects to local aquatic species, and damage to human health or property. The ultimate source of floatable debris in the City stormwater system is litter generated from the improper disposal of waste within the drainage area. Litter left anywhere in the City can ultimately enter the River or WID canal and is therefore a cause for concern. The City will approach the problem with a variety of BMPs, ranging from increased frequency of street sweeping to public education and mechanical separation, as discussed in Section 11.

# 10. Stormwater Management Program Elements

## 10.1. Phase II NPDES Compliance Strategy

The following outlines Phase II NPDES requirements, the City's permit compliance strategy, and the measurable goals the City has developed to meet the requirements.

### *10.1.1. Public Education and Outreach*

The City will implement a two-tiered approach to public education communicating the importance of stormwater quality protection to both adults and children in the community. The developing program will need to be a partnership between the City and area schools.

Adults will be educated through a brochure or flyer possibly included as a mailer with a utility bill from the City and available in City offices. These flyers will be delivered to customers by the end of 2003. The flyer will identify those BMPs that an individual family can implement to protect stormwater, and communicate the importance an individual family can have in protecting natural resources. Potential topics to be covered include:

- Automotive wastes
- Car washing
- Storage of pesticides
- Handling and use of pesticides
- Proper handing and disposal of pet and animal wastes
- Proper handing and disposal of grass clippings, leaves, and other yard waste

Following a brief educational session, local children will participate in a stormwater protection poster contest to be held annually at local schools. Following a brief educational session, local students will be encouraged to participate in a poster contest with a theme relating to stormwater protection. The results will be judged by City public works staff. The winning posters will be posted on a billboard in City Hall or other public place.

Additional public contact will be made through appropriate media and may include presentations at a local theater or newspaper. The City recently agreed to participate in the production of a video aimed at stormwater quality in the Central Valley. This video will be used by the City as a public education tool.

**Table 10-1 - Public Education and Outreach Measureable Goals**

| Target Date | Activity |
|---|---|
| 2003 | Develop bilingual stormwater protection brochures or flyers, and distribute in water utility bills; develop school curricula<br>Continue participation in local events such as the Lodi All Emergency Preparedness Expo |
| 2004 | Begin annual poster contest and post winning posters on bulletin boards around the City<br>Continue participation in local events such as the Lodi All Emergency Preparedness Expo<br>Participate in development of stormwater quality video |
| 2005 | Continue poster contest program<br>Develop and implement community car wash plan<br>Continue participation in local events such as the Lodi All Emergency Preparedness Expo |
| 2006 | Continue poster contest program<br>Implement program to reduce the dumping of pollutants down storm sewer drains<br>Continue participation in local events such as the Lodi All Emergency Preparedness Expo |
| 2007 | Implement program to reduce volume of floating contaminants in storm drain system<br>Continue participation in local events such as the Lodi All Emergency Preparedness Expo |

### *10.1.2. Public Participation/Involvement*

The City will involve the public in completing its storm drain labeling program in a manner similar to the Eagle Scout projects previously completed. All storm drain inlets will be labeled by the end of 2005.

The City will establish a toll-free citizen reporting telephone number or an electronic form linked directly to the Public Works Department. The hotline or form will be advertised through the local media as a way for citizens to participate in protecting stormwater. A typical call to the hotline might report a parked automobile leaking fluid, fresh concrete wash-out dumped onto a City street, paint or oily sheen in the river, or organic debris (including pet waste) in a drainage system or waterway. The City will then promptly respond and attempt to remedy the reported problem. A log of all reported incidents will be maintained and included in the annual NPDES compliance report to RWQCB.

The City will also continue to fund and look for additional grant funding opportunities for the Storm Drain Detectives Program.

**Table 10-2 - Public Participation/Involvement Measureable Goals**

| Target Date | Activity |
|---|---|
| 2003 | Establish citizen reporting hotline or an internet-accessible electronic form<br>Increase participation in Storm Drain Detectives Program |
| 2004 | Generate material in local media promoting hotline or internet-accessible electronic form<br>Respond quickly to hotline complaints |
| 2005 | Complete storm drain labeling |
| 2006 | Generate annual report to citizens on stormwater |
| 2007 | Continue to generate report<br>Evaluate future program needs |

### 10.1.3. Illicit Discharge Detection and Elimination

The City will develop and implement a program to detect and eliminate illicit discharges into the storm sewer system. This program will be based on an updated stormwater protection ordinance, which will be developed in 2003 and put into place in 2004.

As a first phase of the detection program, the City will identify problem areas based on citizen complaints, visual screening, or water sampling from manholes and outfalls during dry weather. Phase II will involve tracking the detected contamination to its source. Methods that can find the source of the illicit discharge include: dye-testing buildings in problem areas; dye- or smoke-testing buildings; tracing the discharge upstream in the storm sewer; employing a field verification program that shows that a building has been checked for illicit connections; or using video to inspect the storm sewers for illicit connections. Following source identification, the offending discharger will be notified in writing and directed to correct the problem within a reasonable time frame. All steps taken under the plan will be documented to illustrate that progress is being made to eliminate illicit connections and discharges to the MS4.

**Table 10-3 - Illicit Discharge Detection and Elimination Measureable Goals**

| Target Date | Activity |
|---|---|
| 2003 | Develop stormwater ordinance<br>Identify and evaluate non-stormwater illicit discharges into MS4 |
| 2004 | Stormwater ordinance in effect<br>Begin program to identify sources of illicit discharges; including record keeping |
| 2005 | Continue Program<br>Eliminate detected illicit discharges |
| 2006 | Continue Program<br>Eliminate detected illicit discharges |
| 2007 | Most illicit discharge sources detected and eliminated |

### 10.1.4. Construction Site Runoff Control

The City will include in their Stormwater Protection Ordinance a section dedicated to construction site runoff control. Key BMPs to be enforced by the ordinance are listed below and detailed in the attachments to this report.

The ordinance will be structured in a manner that rewards compliance. Suggestions include requiring a deposit prior to construction. The deposit would then be used to pay for any fines that may result from improper construction practices. Funds remaining following completion of construction will be returned to the contractor. Probable requirements of the City of Lodi Stormwater Protection Ordinance include:

- Construction entrance
- Tire wash facility
- Outlet protection
- Check dams
- Straw sedimentation barriers

- Inlet protection
- Sand and biofilter bags
- Concrete washout
- Training

Details of each of the requirements can be found in the BMP package included in the Appendix.

Training on the program will be provided to City staff and contractors.

As part of the program, the City will also develop an inspection program to ensure contractors are following the requirements of the ordinance.

**Table 10-4 - Construction Site Runoff Control Measureable Goals**

| Target Date | Activity |
|---|---|
| 2003 | Develop Ordinance<br>Develop training materials<br>Develop inspection program |
| 2004 | Ordinance in place<br>Training program in place<br>Begin construction site inspections |
| 2005 | Increased compliance with ordinance<br>Improved clarity and reduced sedimentation of local waterbodies |
| 2006 | Increased compliance with ordinance<br>Improved clarity and reduced sedimentation of local waterbodies |
| 2007 | Maximum compliance with ordinance<br>Improved clarity and reduced sedimentation of local waterbodies |

### *10.1.5. Post-Construction Runoff Control*

The City will continue to build detention ponds as the size of the City increases and stormwater detention needs grow. The City will also continue its urban forestry program. These and other structural and/or nonstructural BMPs will be required by the Stormwater Protection Ordinance. Potential BMPs are included in the attachments to this report and include BMP inspection and maintenance, grass lined swales, and floatable debris removal. The details of the program will be identified in a Standard Urban Storm Water Mitigation Plan (SUSMP) that will apply to many discretionary development and redevelopment projects that fall into categories identified in Attachment 4 of the permit guidance.

**Table 10-5 - Post-Construction Runoff Control Measureable Goals**

| Target Date | Activity |
|---|---|
| 2003 | Develop ordinance |
| 2004 | Ordinance in place |
| 2005 | Develop SUSMP |
| 2006 | Reduce percent of new impervious surfaces associated with new development projects |
| 2007 | Improved clarity and reduced sedimentation of local waterbodies |

### 10.1.6. Pollution Prevention/Good Housekeeping

To address the pollution from community car washes, the City will develop a program similar to those of King and Kitsap Counties in Washington. The City realizes the fund-raising importance of car washes to many community organizations. For that reason the City provides education and offers devices such as the "Bubble Buster" or drain plugs to protect stormwater quality.

The City recognizes that stormwater pollution resulting from fund-raisers and personal car washes, as well as disposal of chlorinated water from pools or other sources, may detrimentally impact the quality of discharged water. The City will develop and implement a public education program targeting these types of discharges in an effort to reduce their impact, and will consider offering devices designed to prevent the discharge of car wash water to storm drains. Table 10-6 shows the goals of pollution prevention and good housekeeping practices.

**Table 10-6 - Pollution Prevention/Good Housekeeping Measureable Goals**

| Target Date | Activity |
|---|---|
| 2003 | Develop educational brochures developed and outreach program |
| 2004 | Distribute Materials |
| 2005 | Review programs, evaluate and revise as necessary |
| 2006 | Reduce floatables in stormwater<br>Generate annual report on stormwater to citizens |
| 2007 | Generate annual report on stormwater to citizens |

### 10.1.7. Summary of Measurable Goals

Table 10-7 summarizes the BMPs and implementation schedule the City will follow to comply with the Phase II NPDES program.

**Table 10-7 - Implementation Schedule Summary**

| Year | Public Education and Outreach | Public Participation/Involvement | Illicit Discharge Detection and Elimination | Construction Site Runoff Control | Post Construction Runoff Control | Pollution Prevention/Good Housekeeping |
|---|---|---|---|---|---|---|
| 2003 | • Develop bilingual stormwater protection brochures or flyers, and distribute in water utility bills; develop school curricula<br>• Continue participation in local events such as the Lodi All Emergency Preparedness Expo | • Establish citizen reporting hotline or an internet-accessible electronic form<br>• Increase participation in Storm Drain Detectives Program | • Develop stormwater ordinance<br>• Identify and evaluate non-stormwater illicit discharges into MS4 | • Develop Ordinance<br>• Develop training materials<br>• Develop inspection program | • Develop ordinance | • Develop educational brochures developed and outreach program |
| 2004 | • Begin annual poster contest and post winning posters on bulletin boards around the City<br>• Continue participation in local events such as the Lodi All Emergency Preparedness Expo<br>• Participate in development of stormwater quality video | • Generate material in local media promoting hotline or internet-accessible electronic form<br>• Respond quickly to hotline complaints | • Stormwater ordinance in effect<br>• Begin program to identify sources of illicit discharges; including record keeping | • Ordinance in place<br>• Training program in place<br>• Begin construction site inspections | • Ordinance in place | • Distribute Materials |
| 2005 | • Continue poster contest program<br>• Develop and implement community car wash plan<br>• Continue participation in local events such as the Lodi All Emergency Preparedness Expo | • Complete storm drain labeling | • Continue Program<br>• Eliminate detected illicit discharges | • Increased compliance with ordinance<br>• Improved clarity and reduced sedimentation of local waterbodies | • Develop SUSMP | • Review programs, evaluate and revise as necessary |
| 2006 | • Continue poster contest program<br>• Implement program to reduce the dumping of pollutants down storm sewer drains<br>• Continue participation in local events such as the Lodi All Emergency Preparedness Expo | • Generate annual report to citizens on stormwater | • Continue Program<br>• Eliminate detected illicit discharges | • Increased compliance with ordinance<br>• Improved clarity and reduced sedimentation of local waterbodies | • Reduce percent of new impervious surfaces associated with new development projects | • Reduce floatables in stormwater<br>• Generate annual report on stormwater to citizens |
| 2007 | • Implement program to reduce volume of floating contaminants in storm drain system<br>• Continue participation in local events such as the Lodi All Emergency Preparedness Expo | • Continue to generate report<br>• Evaluate future program needs | • Most illicit discharge sources detected and eliminated | • Maximum compliance with ordinance<br>• Improved clarity and reduced sedimentation of local waterbodies<br>▪ | • Improved clarity and reduced sedimentation of local waterbodies | • Generate annual report on stormwater to citizens |

# 11. Program Cost Summary

The costs developed and discussed in this section are in addition to the costs required to operate and maintain the stormwater system. Programs the City currently funds as part of its stormwater program are assumed to continue and will require increased funding as determined in the City's budgeting process.

The total additional budget required for the project will be approximately $120,500 in 2003, $50,500 in 2004, $113,000 in 2005, $29,500 in 2006 and $29,000 in 2007.

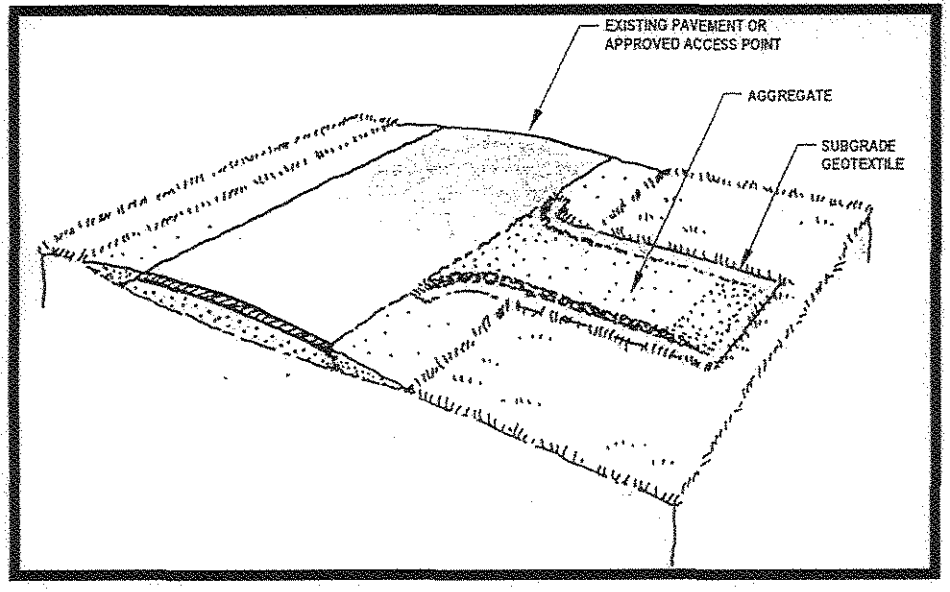
**Table 11-1 - BMP Implementation Cost**

| Year | BMP Description | Discussion | Additional Funding |
|---|---|---|---|
| 2003 | Bilingual stormwater protection brochures or flyers developed and distributed, school curricula developed | Many examples of both flyers and school curricula exist. The City will need to tailor the material to their specific issues and inform the general public. | $5,000-7000 |
| | Establish citizen reporting hotline or an internet-accessible electronic form | Costs include a minimal number of City hours for website development. It is assumed that the City will continue to use its current complaint number as the stormwater hotline. | $1,000 |
| | Increased participation in Storm Drain Detectives Program | Increased participation will most likely result from the growing awareness of stormwater issues that results from the program so only a minimal expenditure will be required. | $1,000 |
| | Develop ordinance | Existing ordinances can be used as a base for the City's ordinance, however, public meetings and legal fees will result in a substantial cost. | $45,000 |
| | Identify and evaluate non-stormwater discharge | The first phase of the program will involve completion of a study to determine the extent and probable discharge location. | $30,000 |
| | Develop training materials for contractors | The cost associated with this task includes material costs and the cost to begin providing training. | $30,000 |
| | Develop inspection program | It is assumed that the responsibilities of current inspectors can be expanded, meaning no additional personnel will be required. | $7,500 |
| | Annual program review and record keeping | The cost of this goal includes a minimal amount of filing time and time required to complete the report. | $4,000 |

| Year | BMP Description | Discussion | Additional Funding |
|---|---|---|---|
| 2004 | Begin annual poster contest and post winning bulletin boards around the City | The poster contest will require a minimal amount of supplies, prizes for winners and hours required for classroom presentations. | $2,000 |
| | Continued costs associated with phone line or internet website | Periodic maintenance or additional advertisement will be necessary to ensure the phone line is effective. | $500 |
| | Participate in development of stormwater quality video | The City's monitory contribution to the regional stormwater video may vary. | $1,000 |
| | Begin program to identify sources of illicit discharges, including record keeping | Costs could vary substantially depending on results of preliminary investigation into sources. | $30,000 |
| | Continued costs associated with contractor training program | Costs include time required to make presentation and purchase of more materials. | $5,000 |
| | Begin inspecting construction sites and requiring stormwater BMP compliance | It is assumed that the responsibilities of current inspectors can be expanded meaning no additional personnel will be required. | $10,000 |
| | Annual program review and record keeping | Cost includes a minimal amount of filing time and some the time required to complete the report. | $4,000 |
| 2005 | Continue poster contest program | The poster contest will require a minimal amount of supplies, prizes for winners and hours required for classroom presentations | $2,000 |
| | Continued costs associated with phone line or internet website | Periodic maintenance or additional advertisement will be necessary to ensure the phone line is effective. | $500 |
| | Develop and implement community car wash plan | Car wash costs include time associated with educating the public and costs required to purchase appropriate devices. | $6,000 |
| | Material in local media promoting hotline or internet-accessible electronic form | Actual material will most likely be developed as a part of other program elements. The cost of distributing the information will be minimal. | $500 |
| | Continue illicit discharge detection program | Program costs are extremely difficult to define as program components have not yet been determined. | $30,000 |
| | Eliminate detected illicit discharges | Project costs are nearly impossible to determine as the number and extent of illicit discharges are not known | $10,000 |
| | Annual program review and record keeping | The cost of this goal includes a minimal amount of filing time and time required to complete the report. | $4,000 |
| | Develop SUSMP | The details of the SUSMP program will be identified under this task. | $60,000 |
| 2006 | Continue poster contest program | The poster contest will require a minimal amount of supplies, prizes for winners, and hours required for classroom presentations. | $2,000 |
| | Implement program to reduce the dumping of pollutants down storm sewer drains | Program costs are extremely difficult to define as program components have not yet been determined. | $1,000 |
| | Continued costs associated with phone line or internet website | Periodic maintenance or additional advertisement will be necessary to ensure the phone line is effective. | $500 |
| | Floatable debris reduction program | Project costs could vary substantially. If other measures are effective in reducing the volume of floatable debris, costs could be significantly less. | $20,000 |
| | Generate annual report to citizens on stormwater | The report will be closely tied to the annual program review. | $2,000 |
| | Annual program review and record keeping | Cost includes a minimal amount of filing time and time required to complete the report. | $4,000 |

| | | | |
|---|---|---|---|
| 2007 | Implement program to reduce the dumping of pollutants down storm sewer drains | Program costs are extremely difficult to define as program components have not yet been determined. | $1,000 |
| | Continue poster contest program | The poster contest will require a minimal amount of supplies, prizes for winners, and hours required for classroom presentations. | $2,000 |
| | Floatable debris reduction program | Project costs could vary substantially. If other measures are effective in reducing the volume of floatable debris, costs could be significantly less. | $20,000 |
| | Generate annual report to citizens on stormwater | The report will be closely tied to the annual program review. | $2,000 |
| | Annual program review and record keeping | Cost includes a minimal amount of filing time and time required to complete the report. | $4,000 |

# Construction Entrance




**Description:**
A stabilized aggregate pad, placed at construction site ingress/egress locations, that reduces the amount of sediment transported onto paved roads by vehicles or runoff.

**Advantages:**
⇒ Reduces traffic hazards caused by debris on public roadways.
⇒ Reduces sediment on roadways that can wash into the storm sewer system.

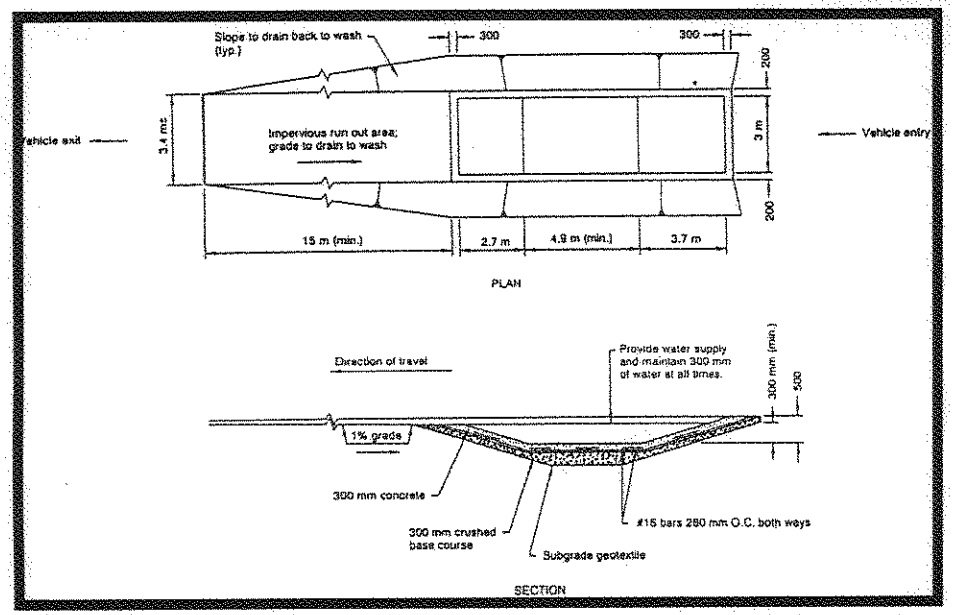
**Disadvantages:**
⇒ Only effective if erosion and sediment control employed elsewhere onsite.
⇒ Only works if installed at every location where significant construction traffic leaves the site.
⇒ Fills with sediment quickly and requires frequent maintenance and/or replacement of rock.
⇒ A common problem is poor installation which can include inadequate depth and length of rock and the failure to replace rock when voids are filled with sediment.

**Applications:**
⇒ Wherever traffic will be leaving a construction site at a rate of at least 25 trips per day and traveling on paved roads or other paved areas located within 100 feet of the site.
⇒ Sites in which permits require gravel, paved or constructed entrances, exits and parking areas to reduce the tracking of sediments onto public or private roads.

**Design Criteria:**
⇒ Minimum length:
  * 50 feet for drainage areas having less than one acre of exposed soil.
  * 100 feet for drainage areas having more than one acre of exposed soil.
⇒ Minimum width: 20 feet.
⇒ Minimum aggregate depth: 7 inches
⇒ Install at construction entrances before beginning grading.
⇒ Whenever possible, construct the pad on a firm, compacted subgrade.
⇒ Place a geotextile under the aggregate on surfaces when fine sediment under the pad could "pump" up and into the pad.
⇒ Do not install aggregate on paved surfaces.
⇒ Install fencing as necessary to restrict construction vehicle traffic to the construction entrance.
⇒ Include a tire wash if the entrance does not prove effective in retaining sediment onsite. This determination will need to be made on a project specific basis.

**Maintenance:**
⇒ Immediately sweep up and remove or stabilize any sediment that is tracked onto pavement.
⇒ If the sediment poses a threat to public safety and street sweeping proves ineffective, consider washing the street and collecting the water in a sediment pond or sump before it leaves the site.
⇒ Add aggregate as needed to maintain the specified dimensions.
⇒ Immediately remove any aggregate which gets carried from the pad to the roadway.
⇒ Maintain fencing installed as traffic control.

# Tire Wash Facility




**Description:**
Two types of tire wash facilities are available depending on the severity of sediment tracking and the size of the project. Type 1 is a stabilized gravel pad similar to a stabilized construction entrance which is graded or otherwise constructed to collect wash water and convey it to a sediment trap, basin or other suitable treatment facility. Type 2 consists of a shallow concrete lined basin partially filled with water, through which exiting vehicles drive.

**Advantages:**
⇒ Reduces traffic hazards caused by debris on public roadways.
⇒ Reduces sediment on roadways, which can wash into the storm sewer system.
⇒ Type 1 is easy to construct and is relatively inexpensive.
⇒ Type 2 is useful for high traffic volumes or large projects of long duration.

**Disadvantages:**
⇒ Only works if installed at every location where construction traffic leaves the site.
⇒ Fills with sediment quickly and requires frequent maintenance.
⇒ Requires a source of wash water.
⇒ Requires a turnout of doublewide exit to avoid entering vehicles having to drive through wash area.
⇒ Type 1 requires labor to wash the tires of all vehicles exiting the site.
⇒ Type 2 is costly to construct and will generate large volumes of sediment-laden water, requiring treatment elsewhere on site.

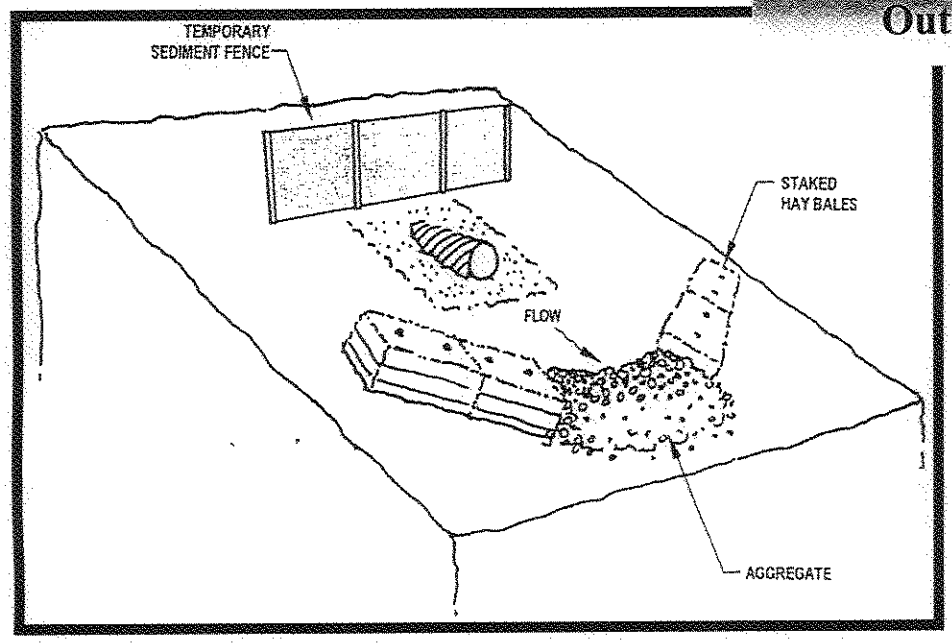
**Applications:**
⇒ Wherever traffic will be leaving a construction site and traveling on paved roads or other paved areas located within 100 feet of the site.
⇒ Where sediment removal on a stabilized construction entrance alone is inadequate to prevent tracking.

**Design Criteria:**
⇒ Type 1: minimum length = 50 feet, minimum width = 20 feet, minimum aggregate depth = 7 inches, must place geotextile under the aggregate when fine sediment under the pad could "pump" up and into the aggregate pad; install fencing as necessary to restrict exiting construction vehicle traffic to the tire wash; and grade the pad to drain to suitable collection and treatment facility.
⇒ Type 2: basin dimensions 40 feet long by 10 feet wide with sloping ingress and egress, and 50 foot long impervious runout area at ingress which drains into basin; line bottom of basin with geotextile and 1 foot of aggregate base coarse; construct basin out of 1 foot concrete with steel reinforcement; provide water supply; provide outlet for sediment-laden water discharge to treatment facility or provide pumps and tanks for water treatment.

**Maintenance:**
⇒ Type 1: wash aggregate pad when sediment clogs aggregate, add or re-grade aggregate as needed, immediately remove any aggregate that gets carried from the pad to the roadway, and ensure that wash water drainage, collection and treatment system is functioning.
⇒ Type 2: remove/discharge wash water as needed, remove accumulated sediment from bottom of basin, and ensure that wash water drainage, collection and treatment system is functioning.

**Common failure:**
The most common problem with this Best Management Practice is failure to maintain the facility.

# Outlet Protection




**Description:**
Outlet protection reduces the speed of concentrated flow, thereby preventing scour at stormwater and conveyance outlets. By dissipating energy, outlet protection lowers the potential for downstream erosion. Outlet protection includes riprap-lined basins, concrete aprons, and settling basins.

**Advantages:**
⇒ Many techniques are effective and relatively inexpensive and easy to install.
⇒ Removes sediment and reduces velocity.

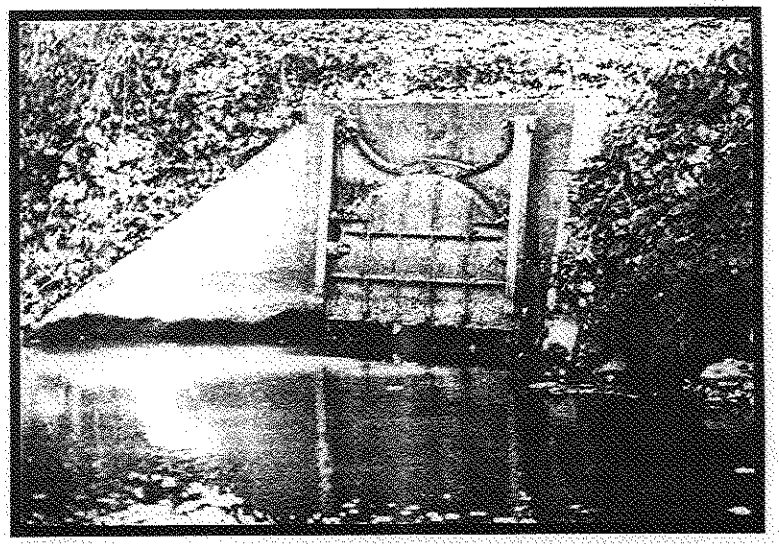
**Disadvantages:**
⇒ Can be unsightly.
⇒ May be difficult to remove sediment without removing and replacing the structure itself.
⇒ Rock outlets with high velocity flows may require frequent maintenance.

**Applications:**
At the outlets of ponds, pipe slope drains, ditches, or other conveyances, and where runoff is conveyed to a natural or man-made drainage feature such as a stream, wetland, lake, or ditch.

**Design Criteria:**
Use the standard detail for outlet protection as a minimum. Consider site conditions to determine if a more complex energy dissipater may be required.

**Maintenance:**
⇒ If there is scour at the outlet, protect the eroded area by increasing the size of the energy dissipater facility.
⇒ Remove accumulated sediment frequently.

**Common Failures:**
The most common problem with this Best Management Practice is underdesign, failure to remove accumulated sediment, and rock that is too small and/or is not angular enough for the runoff velocities (river run or rounded rock is not adequate).



# Check Dam

**Description:**
Check dams are small, temporary dams constructed across a swale or channel. Check dams can be constructed using gravel, rock, sandbags, logs, or straw bales and are used to slow the velocity of concentrated flow in a channel to reduce the erosion in the swale or channel. As a secondary function, check dams can also be used to catch sediment from the channel itself or from the contributing drainage area as storm water runoff flows through the structure.

**Advantages:**
⇒ Reduces the energy of storm water to reduce erosion.
⇒ May aerate water as it passes the check dams.
⇒ Some pre-fabricated check dams are reusable.
⇒ Promotes settling of sediment in runoff.
⇒ Inexpensive and easy to install.

**Disadvantages:**
⇒ Check dams should not be used in live, flowing streams unless approved by an appropriate regulatory agency.
⇒ They should not be used as a stand-alone substitute for other sediment-trapping devices.
⇒ Leaves have been shown to be a significant problem by clogging check dams in the fall. Therefore, they may require increased inspection and maintenance.
⇒ May create turbulence downstream, causing erosion of the channel banks.

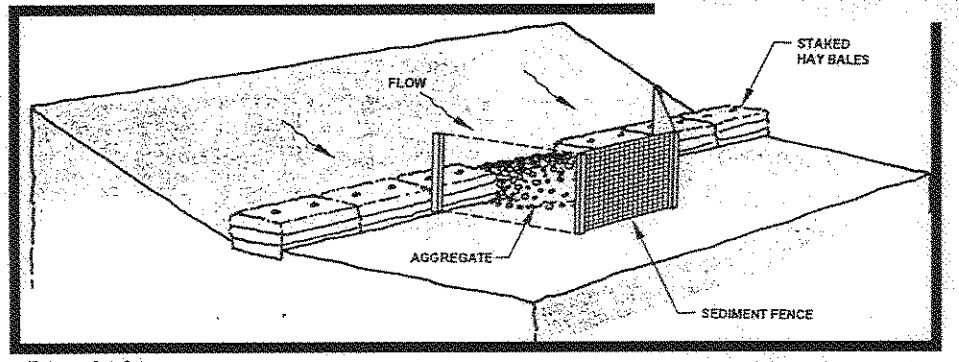
**Applications:**
⇒ Check dams should be used in swales or channels that will be used for a short period of time where it is not practical to line the channel or implement other flow control practices. In addition, check dams are appropriate where temporary seeding has been recently implemented but has not had time to take root and fully develop.
⇒ Check dams are usually used in small open channels with a contributing drainage area of 2 to 10 acres. For a given swale or channel, multiple check dams, spaced at appropriate intervals, can increase overall effectiveness.

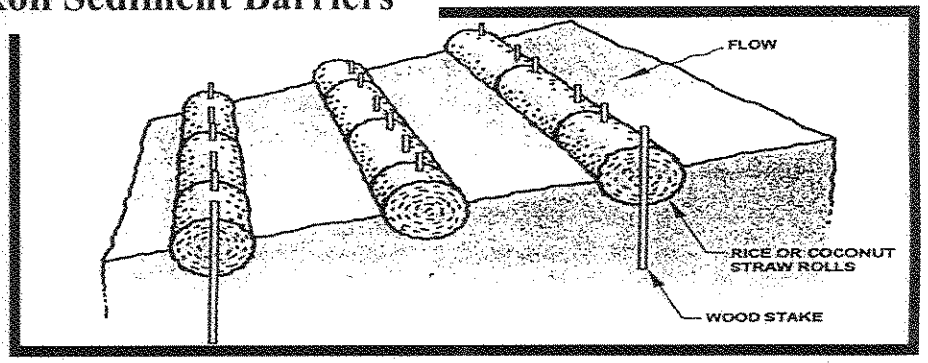
**Design Criteria:**
⇒ Check dams can be constructed from rock, logs, sandbags, straw bales, etc. When using rock or stone, the material diameter should be 2 to 15 inches. Logs should have a diameter of 6 to 8 inches. Dams should be installed with careful placement of the construction material as mere dumping of the dam material into a channel will reduce overall effectiveness.
⇒ All check dams should have a maximum height of 3 feet. The center of the dam should be at least 6 inches lower than the edges. This design creates a weir effect that helps to channel flows away from the banks and prevent further erosion. Additional stability can be achieved by implanting the dam material approximately 6 inches into the sides and bottom of the channel. When installing more than one check dam in a channel, outlet stabilization measures should be installed below the final dam in the series. Because this area is likely to be vulnerable to further erosion, riprap, geotextile lining, or some other stabilization measure is highly recommended.

**Maintenance Considerations:**
⇒ Check dams should be inspected after each storm event to ensure continued effectiveness.
⇒ Large debris, trash, and leaves should be removed.
⇒ The center of a check dam should always be lower than its edges. If erosion or heavy flows cause the edges of a dam to fall to a height equal to or below the height of the center, repairs should be made immediately.
⇒ Accumulated sediment should be removed from the upstream side of a check dam when the sediment has reached a height of approximately one half the original height of the dam (measured at the center).

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Straw Bale or Roll Sediment Barriers




**Description:**

⇒ A temporary sediment barrier consisting of a row of entrenched and anchored straw bales with check dams at low points. Straw bale sediment barriers trap small amounts of sediment by decreasing sheet-flow and low-moderate channel flow velocities. Water is channeled through the aggregate weir and sediment fence is used to trap sediment that has moved through the weir.

⇒ Straw rolls are manufactured from straw that is wrapped in tubular plastic netting. They are approximately 1 foot in diameter by 25 to 30 feet long. Straw rolls are placed in shallow trenches and staked along the contour of newly constructed or disturbed slopes.

**Advantages:**

⇒ Bales are a relatively inexpensive method of sediment control.

⇒ Rolls can often replace sediment fences or bales on steep slopes.

⇒ Rolls store more moisture for vegetation planted immediately upslope.

⇒ May be left in place to biodegrade and/or photodegrade.

⇒ Straw becomes incorporated into the soil with time, adding organic material to the soil and retaining moisture for vegetation.

⇒ Reduces runoff velocity.

⇒ Requires minimal ground disturbance to install.

⇒ Light weight and easy to install.

**Disadvantages:**

⇒ Bales are effective approximately 3 months and rolls only function for one or two seasons.

⇒ Misuse or incorrect installation can contribute to sediment loading.

⇒ Difficult to tell if bales are properly installed.

⇒ Heavy and hard to move when wet.

⇒ Improper placement and/or installation can allow undercutting and end-flow and rolls may fail during the first rain event.

⇒ Low sediment retaining capacity of rolls may require frequent maintenance.

⇒ Rolls may require extra maintenance to ensure that the stakes are holding and the rolls are still in contact with the soil (especially on steep slopes).

**Applications:**

⇒ Bales can be used below areas subject to sheet and rill erosion. Slopes should be 1:2 or flatter.

⇒ Rolls can be used to capture and retain sediment on slopes, temporarily stabilize slopes by reducing soil creep and sheet and rill erosion until permanent vegetation can get established, and control erosion from entering paved areas (like sidewalks).

**Design Criteria:**

⇒ Bales: Contributing drainage should be less than 0.75 acre per 300 feet of bale length. Bales should be placed in a single row, lengthwise, oriented perpendicular to the flow, and with ends of adjacent bales tightly abutting one another. Each bale shall be embedded in the soil a minimum of a half inch. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales. The bales should be anchored in place by two wooden stakes or rebar driven through the bales.

⇒ Rolls: Slopes must be prepared before rolls are installed. Rills and shallow gullies should be smoothed as work progresses. Dig small trenches across the slope on contour to place rolls in. Start building trenches and install rolls from the bottom of the slope and work up. It is critical that rolls are installed perpendicular to water movement, parallel to the slope contour. Use a straight bar to drive holes through the roll and into the soil for the willow or wooden stakes.

**Maintenance:**

⇒ Inspect the bales or rolls periodically during the winter and after significant storms. Repairs and/or replacement shall be made promptly.

⇒ Sediment shall be removed when it has reached 1/3 height of the bales.

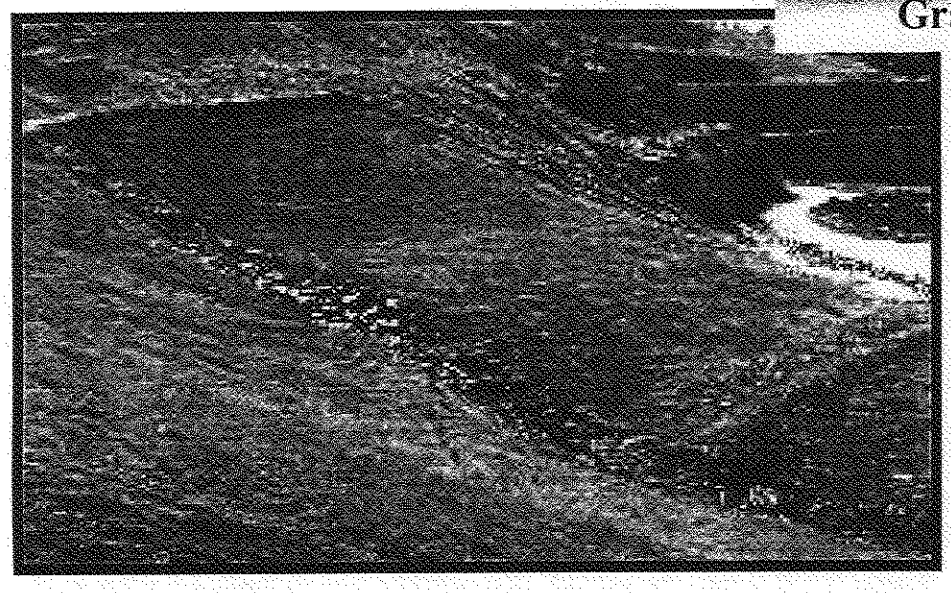
⇒ Replace deteriorated bales.

⇒ Make sure the rolls are in contact with the soil during inspections.

⇒ Repair any rills or gullies promptly.

⇒ Re-seed or replant vegetation if necessary until the slope is stabilized.

# Grass-lined Swale



**Description**:
The term swale (a.k.a. grassed channel, dry swale, wet swale, biofilter) refers to a series of vegetated, open channel management practices designed specifically to treat and attenuate storm water runoff for a specified water quality volume. As storm water runoff flows through these channels, it is treated through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Variations of the grassed swale include the grassed channel, dry swale, and wet swale. The specific design features and methods of treatment differ in each of these designs, but all are improvements on the traditional drainage ditch. These designs incorporate modified geometry and other features for use of the swale as a treatment and conveyance practice.

**Advantages:**
- ⇒ Can be used along roadsides or parking lots to collect and treat stormwater runoff. Capture a great deal of sediment due to the filtering effect of vegetation.
- ⇒ Do not generate high velocity runoff and offer temporary slope protection.
- ⇒ Usually easy to install.

**Disadvantages:**
- ⇒ Grassed swales cannot treat a very large drainage area.
- ⇒ Wet swales may become a nuisance due to mosquito breeding.
- ⇒ If designed improperly (e.g., if proper slope is not achieved), grassed channels will have very little pollutant removal.
- ⇒ A thick vegetative cover is needed for these practices to function properly.

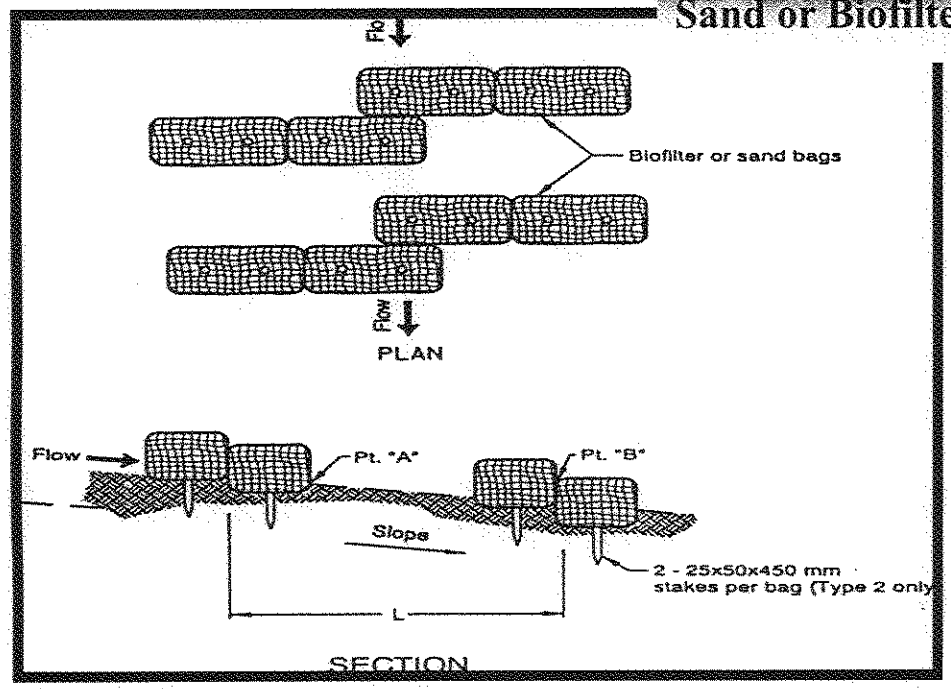
**Applications:**
Grassed swales can be applied in most situations with some restrictions. Swales are very well suited for treating highway or residential road runoff because they are linear practices. Grassed swales can be applied in most regions of the country. In arid and semi-arid climates, however, the value of these practices needs to be weighed against the water needed to irrigate them. Grassed swales are generally not well suited to ultra-urban areas because they require a relatively large area of pervious surfaces.

**Design Criteria:**
- ⇒ Swales should generally have a trapezoidal or parabolic cross section with relatively flat side slopes (flatter than 3:1). The wetted perimeter is the length along the edge of the swale cross section where runoff flowing through the swale is in contact with the vegetated sides and bottom of the swale. The minimum width ensures a minimum filtering surface for water quality treatment, and the maximum width prevents braiding, the formation of small channels within the swale bottom.
- ⇒ A small forebay should be used at the front of the swale to trap incoming sediments. A small trench filled with river run gravel should be used as pretreatment for runoff entering the sides of the swale.
- ⇒ A flat longitudinal slope (generally between 1 percent and 2 percent) and a dense vegetative cover in the channel should be used to help to reduce the velocity of flow in the channel. During construction, it is important to stabilize the channel before the turf has been established, either with a temporary grass cover or with the use of natural or synthetic erosion control products.

**Maintenance:**
- ⇒ Inspect pea gravel diaphragm for clogging and correct the problem.
- ⇒ Inspect grass along side slopes for erosion and formation of rills or gullies and correct.
- ⇒ Remove trash and debris accumulated in the inflow forebay.
- ⇒ Inspect and correct erosion problems in the sand/soil bed of dry swales.
- ⇒ Based on inspection, plant an alternative grass species if the original grass cover has not been successfully established.
- ⇒ Replant wetland species (for wet swale) if not sufficiently established.
- ⇒ Rototill or cultivate the surface of the sand/soil bed of dry swales if the swale does not draw down within 48 hours.
- ⇒ Remove sediment build-up within the bottom of the swale once it has accumulated to 25 percent of the original design volume.
- ⇒ Mow grass to maintain a height of 3–4 inches.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Sand or Biofilter Bag Sediment Barriers




**Description:**

⇒ Biofilter bags are manufactured from 100% recycled wood-product waste placed in plastic mesh bags. They are typically 2.5 feet long by 1.5 feet wide and weigh approximately 44 pounds.

⇒ Sandbags are manufactured from durable, weather resistant, tightly woven material sufficient to prohibit leakage of the filter material. The bags should measure 2 feet long by 1 foot by a half foot and be filled with firmly packed sand weighing at least 75 pounds.

**Advantages:**

⇒ Bags are easy to move, replace and reuse on paved surfaces.

⇒ Bags are good short-term solution in situations where concentrated flows are causing erosion (can be stuffed or staked in developing rills).

⇒ Installation is simple, can be done by hand, and at relatively low cost.

⇒ Biofilter bags can be used in place of sediment fences or straw bales on slopes and the wood-product can be recycled or used on site when no longer needed.

⇒ Sand bags can be used to divert and slow velocity of small flows, and to capture sediment in concrete lined ditches.

**Disadvantages:**

⇒ Generally effective for only a few months.

⇒ Can be easily damaged by construction equipment or by traffic in paved areas.

⇒ Sand bags can contribute sediment to runoff if bags rupture.

⇒ Biofilter bags can become clogged with sediment and cease to filter runoff.

**Applications:**

⇒ To capture and retain sediment on slopes.

⇒ To capture sediment around drain inlets.

⇒ To capture sediment and reduce water velocity on paved streets.

⇒ To capture sediment and reduce water velocity in unlined and lined channels, swales or ditches.

⇒ Can be placed in developing rills or gullies to capture sediment and reduce water velocity

**Design Criteria:**

⇒ On slope applications, it should be installed on contour.

⇒ Ends of bags must be tightly abutted and overlapped to direct flow away from bag joints.

⇒ Install two stakes per biofilter bag.

⇒ Stakes are not needed in paved areas.

**Maintenance:**

⇒ Inspect bag installations after storms. Check that stakes are secure and ends of bags are tightly abutted. Check that undercutting or end-flow is not occurring.

⇒ Check that flow is not becoming channeled behind bags (parallel to row of bags).

⇒ Inspect plastic mesh for tears on biofilter bags.

⇒ Remove sediment accumulated behind bags when sediment reaches one-third of the barrier height.

⇒ Replace damaged bags as needed.

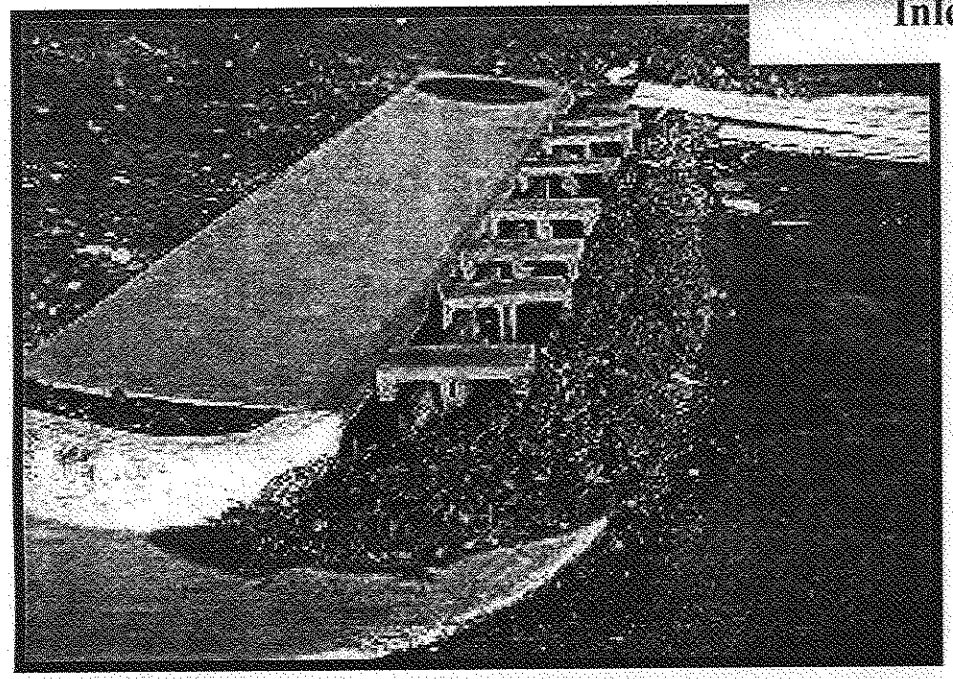
**Common Failures:**

⇒ Failures most commonly result from bags not being tightly abutted together or properly staked, which allows flow between or under the bags causing rilling.

⇒ Failure occurs when the bags are not installed on contour and water flow becomes channeled behind the bags.

⇒ Sandbags can also be dislodged when placed in high velocity flows.

# Inlet Protection



**Description:**
Storm drain inlet protection measures are controls that help prevent soil and site erosion debris from entering storm drain drop inlets. Typically, these measures are temporary controls that are implemented prior to large-scale disturbance of the surrounding site. These controls are advantageous because their implementation allows storm drains to be used during the early stages of construction activities. The early use of storm drains during project development significantly reduces the occurrence of future erosion problems.

**Advantages:**
- ⇒ Reduces amount of sediment leaving the site.
- ⇒ Prevents sediment from entering the storm drain system.

**Disadvantages:**
- ⇒ Should not be used as stand-alone sediment control measures. Should be used with other measures, such as small impoundments or sediment traps.
- ⇒ Temporary storm drain inlet protection is not intended for use in drainage areas larger than 1 acre.
- ⇒ Only practical for relatively low-sediment, low-volume flows.
- ⇒ Frequent maintenance is necessary to prevent clogging. If sediment and other debris clog the water intake, drop intake control measures can actually cause erosion in unprotected areas.
- ⇒ Short-circuiting of flow may occur if not properly installed.

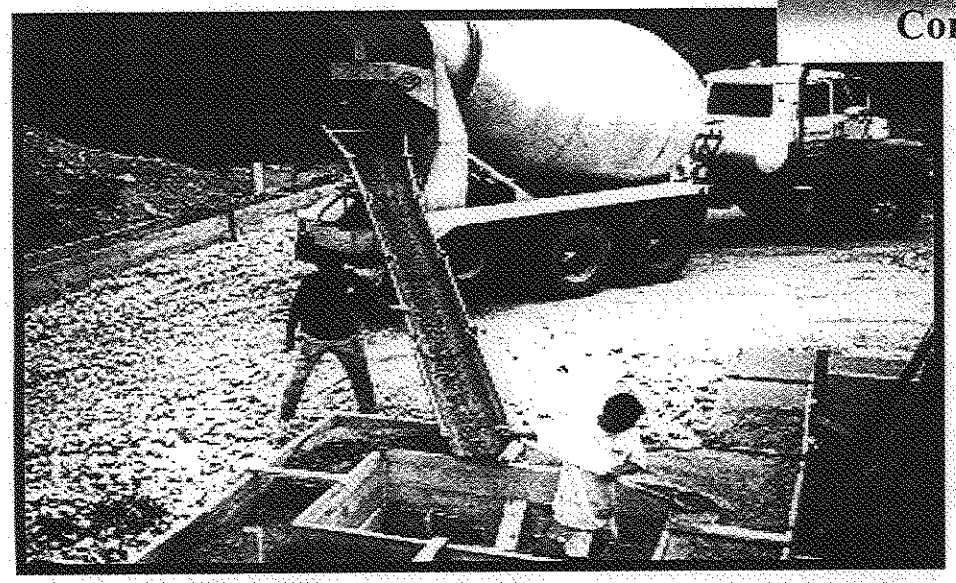
**Applications:**
- ⇒ Drainage area no greater than 1 acre per inlet.
- ⇒ Excavated drop inlet protection and block and gravel inlet protection for areas of high flow where overflow is anticipated into the storm drain.
- ⇒ Fabric barriers are recommended for smaller, relatively flat drainage areas (slopes less than 5 percent leading to the storm drain). Temporary drop inlet control measures are often used in combination with each other and other storm water control techniques.

**Design Criteria:**
These controls should be installed before any soil disturbance in the drainage area.
- ⇒ Excavation around drop inlets should be dug a minimum of 1 foot deep (2 feet max) with a minimum excavated volume of 35 $yd^3$ per acre disturbed. Side slopes leading to the inlet should be no steeper than 2:1. The shape of the excavated area should be designed such that the dimensions fit the area from which storm water is anticipated to drain.
- ⇒ Fabric inlet protection should be staked close to the inlet to prevent overflow on unprotected soils. Stakes should be used with a minimum length of 3 feet, spaced no more than 3 feet apart. A frame should be constructed for fabric support during overflow periods and should be buried at least 1 foot below the soil surface and rise to a height no greater than 1.5 feet above ground. The top of the frame and fabric should be below the down-slope ground elevation to prevent runoff bypassing the inlet.
- ⇒ Block and gravel inlet barrier height should be 1 foot minimum (2 feet max), and mortar should not be used. The bottom row of blocks should be laid at least 2 inches below the soil surface flush against the drain for stability. One block in the bottom row should be placed on each side of the inlet on its side to allow drainage. Wire mesh (1/2 inch) should be placed over all block openings to prevent gravel from entering the inlet, and gravel (3/4 to 1/2 inch in diameter) should be placed outside the block structure at a slope no greater than 2:1.

**Maintenance:**
All temporary control measures must be checked after each storm event. To maintain the sediment capacity of the shallow settling pools created from these techniques, accumulated sediment should be removed from the area around the drop inlet (excavated area, around fabric barrier, or around block structure) when the sediment capacity is reduced by approximately 50 percent. Additional debris should be removed from the shallow pools on a periodic basis. Weep holes in excavated areas around inlets can become clogged and prevent water from draining out of shallow pools that form. Should this happen, unclogging the water intake may be difficult and costly.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Concrete Washout



**Description:**
Concrete waste has potential to raise the pH of water and runoff sediment. When washing concrete off equipment and other materials, care must be taken to minimize the environmental impact by minimizing and containing the washout runoff.

**Guidelines:**
Concrete washouts should minimize water use and be performed in designated areas only (at least 50 feet away from any drainage facility or watercourse).

**Tips for Containment:**
- ⇒ Use a 55-gallon drum or other appropriate container large enough to completely contain the liquid and solid concrete waste. Make sure the drum lid is secure during transportation.
- ⇒ Construct a temporary pit away from drain inlets that will completely contain the concrete waste. This can be done by digging a hole in the ground, or by constructing a bermed area using sand bags or straw bales. Be sure to check with your supervisor before placing concrete waste on the ground. There may be local requirements or other environmental restrictions regarding concrete waste disposal.
- ⇒ Plastic bags can be used if nothing else is available. Avoid breaking the bags open by double-bagging and only filling the bags to about 1/5 of their capacity.

**Temporary Concrete Washout Facility (Above Grade)**
- ⇒ The recommended minimum length and minimum width of 10 feet with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
- ⇒ Plastic lining material shall be a minimum of 60 mil polyethylene sheeting and shall be free of holes, tears, or other defects that compromise the impermeability of the material.

**Temporary Concrete Washout Facility (Below Grade)**
- ⇒ The recommended minimum length and minimum width of 10 feet with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.

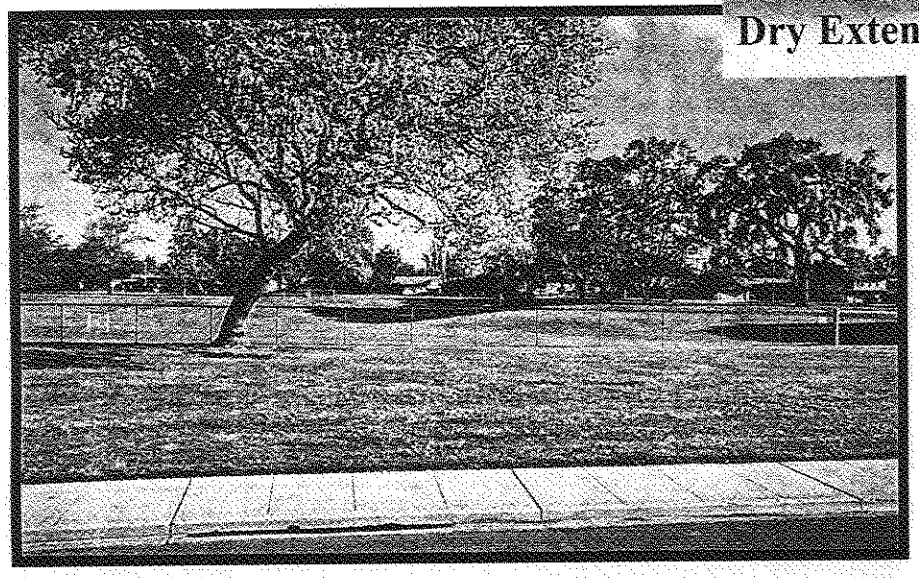
**Disposal Options:**
- ⇒ Allow the solids to settle in the containers used to store the concrete waste.
- ⇒ The water at the top of the settled solids may have an unacceptably high pH and should not be discharged to the storm drain system.
- ⇒ Decant the clear water from the top of the settled solids to the wash rack or other area that drains to the sanitary sewer.
- ⇒ If no sanitary sewer is available, allow the water to evaporate. A pit may be constructed as described above for evaporation.
- ⇒ Allow the settled solids to dry. Recycle concrete waste material, if possible, or dispose as solid waste in the trash dumpster.

**Discharge to Storm Water Drainage System Prevention:**
- ⇒ Avoid conducting concrete work while it is raining.
- ⇒ Protect downstream drain inlets during concrete paving, coring, drilling, cutting, mudjacking, and sawcutting activities.
- ⇒ Shovel or vacuum concrete residue into appropriate containers.
- ⇒ Remove excess material from the roadway where practical.
- ⇒ Use an appropriate container to capture excess material when cleaning out equipment.
- ⇒ Transport excess material back to the maintenance facility or approved storage site.

**Removal of Facilities**
When temporary concrete facilities are no longer required, the hardened concrete shall be removed and disposed of.
Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and repaired.
Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 4 inches for above grade facilities and 12 inches before grade facilities.
Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.


Source: Caltrans Storm Water Pollution Prevention Bulletin. Vol.2. No.1. January 25, 1999.

# Dry Extended Detention Pond



**Description:**
Dry extended detention ponds (a.k.a. dry ponds, extended detention basins, detention ponds, extended detention ponds) are basins whose outlets have been designed to detain the storm water runoff from a water quality design storm for some minimum time (e.g., 24 hours) to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool. However, they are often designed with small pools at the inlet and outlet of the basin. They can also be used to provide flood control by including additional flood detention storage.

**Advantages:**
⇒ Provides flood control, channel protection, as well as some pollutant removal.
⇒ Least expensive storm water management practice (per unit area treated).

**Disadvantages:**
⇒ Have only moderate pollutant removal when compared to other structural storm water practices, and they are ineffective at removing soluble pollutants.
⇒ May become a nuisance due to mosquito breeding.
⇒ Habitat destruction may occur during construction if the pond is designed in-stream or within the stream buffer.
⇒ Although wet ponds can increase property values, dry ponds can actually detract from the value of a home.
⇒ Dry extended detention ponds on their own only provide peak flow reduction and do little to control overall runoff volume, which could result in adverse downstream impacts.

**Applications:**
Dry extended detention ponds are among the most widely applicable storm water management practices. Although they have limited applicability in highly urbanized settings, they have few restrictions.
⇒ Dry extended detention ponds can be applied in all regions of the United States. Some minor design modifications might be needed, however, in cold or arid climates or in regions with karst (i.e. limestone) topography.
⇒ Ultra-urban areas, where little pervious surface is present, it is difficult to use dry extended detention ponds in the ultra-urban environment because of the land area each pond consumes. They can, however, be used in an ultra-urban environment if a relatively large area is available downstream of the pond.
⇒ Storm water hot spots are areas where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in storm water. Dry extended detention ponds can accept runoff from storm water hot spots, but they need significant separation from ground water if they will be used for this purpose.
⇒ A storm water retrofit is a storm water management practice (usually structural) put into place after development has occurred to improve water quality, protect downstream channels, reduce flooding, or meet other specific objectives. Dry extended detention ponds are very useful storm water retrofits, and they have two primary applications as a retrofit design. In many communities, detention basins have been designed for flood control. It is possible to modify these facilities to incorporate features that encourage water quality control and/or channel protection. It is also possible to construct new dry ponds in open areas of a watershed to capture existing drainage.

Overall, dry extended detention ponds increased temperature by about 5°F. In cold water streams, dry ponds should be designed to detain storm water for a relatively short time (i.e., less than 12 hours) to minimize the amount of warming that occurs in the practice.

**Design Criteria:**
The design features can be divided into five basic categories: pretreatment, treatment, conveyance, maintenance reduction, and landscaping.
⇒ Pretreatment settles out coarse sediment particles from runoff before they reach the large permanent pool. In ponds, pretreatment is achieved with a sediment forebay, which is a small pool (typically about 10 percent of the volume of water to be treated for pollutant removal).
⇒ Treatment design features help enhance the ability of a storm water management practice to remove pollutants by designing dry ponds with a high length-to-width ratio (i.e., at least 1.5:1) and incorporating other design features to maximize the flow path to effectively increase the detention time in the system by eliminating the potential of flow to short-circuit the pond. Designing

# Dry Extended Detention Pond (continued)

ponds with relatively flat side slopes can also help to lengthen the effective flow path. Finally, the pond should be sized to detain the volume of runoff to be treated between 12 and 48 hours.

⇒ Storm water should be conveyed to and from storm water management practices safely in a manner that minimizes erosion potential. The outfall of pond systems should always be stabilized to prevent scour. To convey low flows through the system, designers should provide a pilot channel. A pilot channel is a surface channel that should be used to convey low flows through the pond. In addition, an emergency spillway should be provided to safely convey large flood events. To help mitigate warming at the outlet channel, designers should provide shade around the channel at the pond outlet.

⇒ To ease the maintenance burden of each practice, a "micropool" at the outlet can prevent resuspension of sediment and outlet clogging. A good design includes maintenance access to the forebay and micropool. Another design feature that can reduce maintenance needs is a non-clogging outlet. Typical examples include a reverse-slope pipe or a weir outlet with a trash rack. A reverse slope pipe draws from below the permanent pool extending in a reverse angle up to the riser and determines the water elevation of the micropool. Because these outlets draw water from below the level of the permanent pool, they are less likely to be clogged by floating debris.

⇒ Designers should maintain a vegetated buffer around the pond and should select plants within the extended detention zone (i.e., the portion of the pond up to the elevation where storm water is detained) that can withstand both wet and dry periods. The side slopes of dry ponds should be relatively flat to increase safety.

There are also several variations in design for detention ponds.

⇒ Dry detention ponds are similar in design to extended detention ponds. However, they do not incorporate features to improve water quality. In particular, these practices do not detain storm water from small flow events.

⇒ Another variation of the dry detention pond design is the use of tank storage. In this design, storm water runoff is conveyed to large storage tanks or vaults underground. This practice is most often used in the ultra-urban environment, on small sites where no other opportunity is available to provide flood control. Tank storage is provided on small areas because providing underground storage for a large drainage area would generally be cost-prohibitive. Because the drainage area contributing to tank storage is typically small, the outlet diameter needed to reduce the flow from very small storms would be very small. A very small outlet diameter, along with the underground location of the tanks, creates the potential for debris to be caught in the outlet and could result in maintenance problems. Since it is necessary to control small runoff events (such as the runoff from a 1-inch storm) to improve water quality, it is generally unfeasible to use tank storage for water quality and generally impractical to use it to protect stream channels.

⇒ In arid and semi-arid regions, some modifications might be needed to conserve scarce water resources. Any landscaping plans should prescribe drought-tolerant vegetation wherever possible. In addition, the wet forebay can be replaced with an alternative dry pretreatment, such as a detention cell. One opportunity in regions with a distinct wet and dry season, as in many arid regions, is the use of regional extended detention ponds as a recreation area, such as a ball field during the dry season.

**Maintenance:**

⇒ Semi-annually note erosion of pond banks or bottom.

⇒ Annually inspect for damage to the embankment.

⇒ Annually monitor for sediment accumulation in the facility and forebay. Examine to ensure that inlet and outlet devices are free of debris and are operational.

⇒ Repair undercut or eroded areas, mow side slopes, manage pesticide and nutrients, and remove litter and debris as standard maintenance.

⇒ Annually seed or sod to restore dead or damaged ground cover.

⇒ Remove sediment from the forebay every 5 to 7 years.

⇒ Monitor sediment accumulations and remove sediment when the pond volume has been reduced by 25 percent (every 25 to 50 years).

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Urban Forestry

**Description:**
Urban forestry is the practice of establishing and maintaining trees and forests in and around towns and cities. Since trees absorb water, patches of forest and the trees that line streets can help provide some of the storm water management required in an urban setting. Urban forests also help break up a landscape of impervious cover, provide small but essential green spaces, and link walkways and trails.

Successful urban forestry requires a conservation plan for individual trees as well as forest areas larger than 0.25 acres. A local forest or tree ordinance is one technique for achieving conservation, and when specific measures to protect and manage these areas are included, urban forests and trees can also help reduce storm water management needs in urban areas.

**Advantages:**
⇒ Trees absorb carbon dioxide, reduce temperature, and provide habitat for urban wildlife.
⇒ Urban forests can act as natural storm water management areas by filtering particulate matter (pollutants, nutrients, and sediment) and by absorbing water.
⇒ Reduction of noise levels and increased recreation benefits and property values.

**Disadvantages:**
⇒ Development pressure often conflicts with urban forestry measures.
⇒ The size of the land may limit the ability to protect individual trees.
⇒ Forests may harbor undesirable wildlife elements, including insects and other pests. If forests border houses, this may be a concern for residents.

**Applications:**
⇒ From a stream preservation perspective, it is ideal to retain as much contiguous forest as possible. At the same time, this may not be an option in many urban areas. If forested areas are fragmented, it is ideal to retain the closest fragments together.
⇒ In rapidly urbanizing areas, where clearing and grading are important, tree preservation areas should be clearly marked. Delineating lines along a CRZ rather than a straight line is essential to preserving trees and can help reduce homeowner complaints about tree root interference into sewer or septic lines.

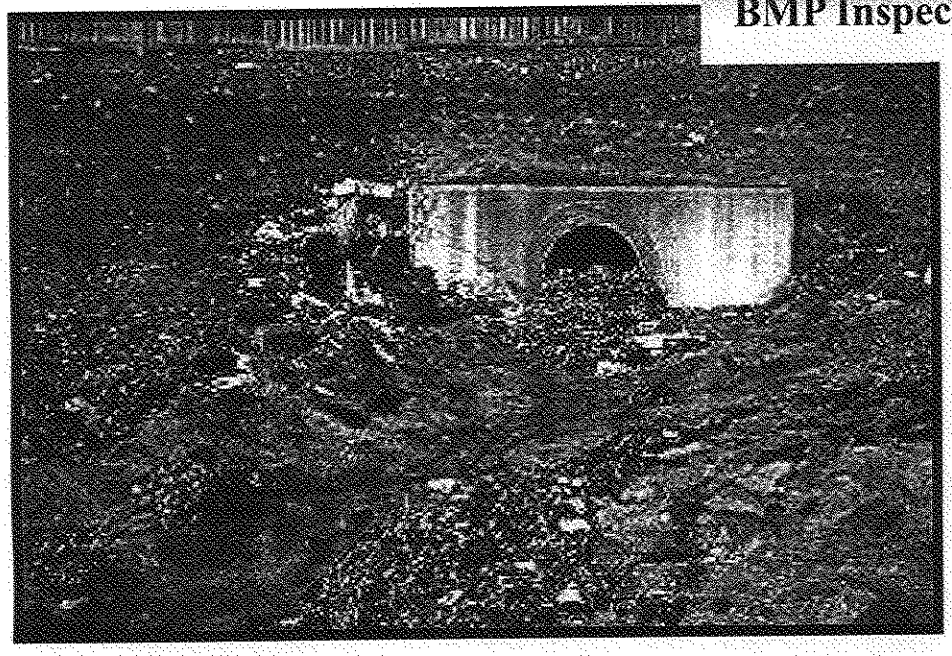
**Implementation:**
The concept of the Critical Root Zone (CRZ) is essential to a proper management plan. The CRZ is the area required around a tree for the tree's survival. Determined by the tree size and species, as well as soil conditions for isolated specimen trees, the CRZ can be estimated as 1 1/2 feet of radial distance for every inch of tree diameter. In larger areas of trees, the CRZ of forests can be estimated at 1 foot of radial distance for every inch of tree diameter, or a minimum of 8 feet. An urban forestry plan should include measures to establish, conserve, and/or reestablish preservation areas. A forest preservation ordinance is one way to set design standards outlining how a forest should be preserved and managed. The ordinance should outline some basic management techniques and should contain some essential elements. The following is a list of some typical elements of a forest conservation plan:

- A map and narrative description of the forest and the surrounding area that includes topography, soils, streams, current forested and unforested areas, tree lines, critical habitats, and 100-year flood plain.
- An assessment that establishes preservation, reforestation, and afforestation areas.
- A forest conservation map that outlines forest retention areas, reforestation, afforestation, protective devices, limits of disturbance, and stockpile areas.
- A schedule of any additional construction in and around the forest area.
- A specific management plan, including tree and forest protection measures.
- A reforestation and afforestation plan.

**Maintenance:**
⇒ May require fringe landscaping and trash pick-up. By using native vegetation and keeping the area as natural as possible, maintenance can be minimized.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# BMP Inspection and Maintenance



**Description:**
To maintain the effectiveness of postconstruction storm water control best management practices (BMPs), regular inspection of control measures is essential. Generally, inspection and maintenance of BMPs can be categorized into two groups—expected routine maintenance and nonroutine (repair) maintenance. Routine maintenance refers to checks performed on a regular basis to keep the BMP in good working order and aesthetically pleasing. In addition to maintaining the effectiveness of storm water BMPs and reducing the incidence of pests, proper inspection and maintenance is essential to avoid the health and safety threats inherent in BMP neglect. The failure of structural storm water BMPs can lead to downstream flooding, causing property damage, injury, and even death.

**Advantages:**

⇒ Efficient way to prevent nuisance situations (odors, mosquitoes, weeds, etc.), reduce the need for repair maintenance, and reduce the chance of polluting storm water runoff by finding and correcting problems before the next rain.

⇒ Because maintenance work for storm water BMPs is usually not technically complicated (mowing, removal of sediment, etc.), workers can be drawn from a large labor pool.

**Disadvantages:**

⇒ As structural BMPs increase in their sophistication, more specialized (more costly) maintenance training might be needed to sustain BMP effectiveness.

⇒ Not all materials that may be needed for emergency structural repairs are immediately available.

**Applicability:**
Under the proposed Storm Water Phase II rule, owners and operators of small municipal separate storm sewer system (MS4) facilities would be responsible for implementing BMP inspection and maintenance programs and having penalties in place to deter infractions.

⇒ All storm water BMPs should be inspected for continued effectiveness and structural integrity on a regular basis. Generally, all BMPs should be checked after each storm event in addition to these regularly scheduled inspections.

⇒ Scheduled inspections will vary among BMPs. Structural BMPs such as storm drain drop inlet protection may require more frequent inspection to ensure proper operation.

⇒ During each inspection, the inspector should document whether the BMP is performing correctly, if there has been any damage to the BMP since the last inspection, and what should be done to repair the BMP if damage has occurred.

**Siting and Design Considerations:**

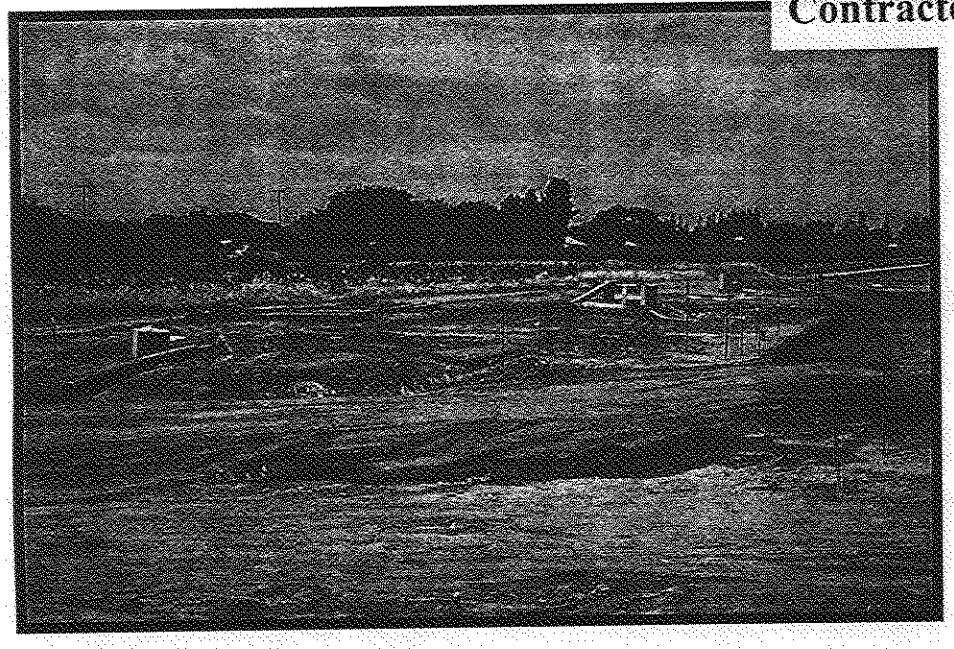
⇒ In the case of vegetative or other infiltration BMPs, inspection of storm water management practices following a storm event should occur after the expected drawdown period for a given BMP. This allows the inspector to see whether detention and infiltration devices are draining correctly.

⇒ Inspection checklists should be developed for use by BMP inspectors. Checklists might include each BMP's minimum performance expectations, design criteria, structural specifications, date of implementation, and expected life span. In addition, the maintenance requirements for each BMP should be listed on the inspection checklist. This will aid the inspector in determining whether a BMP's maintenance schedule is adequate or needs revision. Also, a checklist will help the inspector determine renovation or repair needs.

**Maintenance:**
It is important that routine maintenance and nonroutine repair of storm water BMPs be done according to schedule or as soon as a problem is discovered. Because many BMPs are rendered ineffective for runoff control if not installed and maintained properly, it is essential that maintenance schedules are maintained and repairs are made promptly. In fact, some cases of BMP neglect can have detrimental effects on the landscape and increase the potential for erosion. However, "routine" maintenance, such as mowing grasses, should be flexible enough to accommodate the fluctuations in need based on relative weather conditions. For example, more harm may be caused by mowing during an extremely dry period or immediately following a storm event.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Contractor/Inspector Training



**Description:**
In many municipalities, erosion and sediment control (ESC) plans are required under ordinances enacted to protect water resources. These plans describe how a contractor or developer will reduce soil erosion and contain and treat runoff that is carrying eroded sediments. Plans typically include descriptions and locations of soil stabilization practices, perimeter controls, and runoff treatment facilities that will be installed and maintained before and during construction activities. In addition to special area considerations, the full ESC plan review inventory should include:

- Topographic and vicinity maps
- Site development plan
- Construction schedule
- ESC plan drawings
- Detailed drawings and specifications for practices
- Design calculations
- Vegetation plan.

Municipalities often do not have the funding and staffing resources to support a construction site inspection program. Municipalities can implement a private inspector program in which individuals can receive stormwater management and ESC training to become certified inspectors to reduce the burden on the governing agency. These private inspectors can be hired directly by the contractor when the governing agency anticipates that a larger, more complicated site will require substantial agency resources. Contractor certification programs are supplements to a municipal inspection and enforcement program.

**Applications:**

⇒ Contractor certification programs for municipalities that require erosion and sediment control plans for construction sites. Training and certification will help to ensure that the plans are properly implemented and that best management practices are properly installed and maintained.

⇒ Inspector training programs for municipalities with limited funding and resources for ESC program implementation. The inspectors will lighten the financial and staffing burden of governing agencies to ensure compliance on construction sites.

**Benefits:**
Contractors are the individuals ultimately responsible for the proper installation and maintenance of ESC practices on construction sites. A contractor certification program will help to improve compliance with ESC programs and foster better relationships between contractors and regulators. Inspector training programs can help to enforce compliance by limiting the burden of inspection for local regulatory agencies. By freeing up staff and other resources, more frequent and thorough inspections can be made.

**Limitations:**
Contractor certification and inspector training programs require a substantial amount of effort on the part of the municipality or regulatory agency. They need to develop curricula for training courses, dedicate staff to teach courses, and maintain a report review and site inspection staff to ensure that both contractors and inspectors are fulfilling their obligations and complying with the ESC program.

**Implementation:**
Contractor certification can be accomplished through municipally sponsored training courses, or more informally, municipalities can hold mandatory preconstruction or pre-wintering meetings and conduct regular and final inspection visits to transfer information to contractors. Information that should be covered in training courses and meetings includes the importance of ESC for water quality protection, developing and implementing ESC plans, the importance of proper installation, regular inspection, and diligent maintenance of ESC practices, and record-keeping for inspections and maintenance activities. To implement an inspector training program, the governing agency would need to establish a certification course with periodic recertification, review reports submitted by private inspectors, conduct spot checks for accuracy, and institute fines or other penalties for noncompliance.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Educational Pamphlets

**Description:**
Printed materials are a common way to inform the public about storm water pollution. Some municipalities have a public relations department or a staff member that handles these outreach materials, whereas others contract with public relations firms and graphic designers to develop materials. Regardless of who actually produces the materials, municipalities should be creative when deciding which media to use and what types of messages are appropriate for those media. Some common printed materials include educational displays, pamphlets, booklets, and utility stuffers.

**Advantages:**
⇒ Can be tailored to many different types of audiences.
⇒ A brochure can be written for the general public and later edited so that it reaches individuals within the storm water industry.
⇒ Relatively inexpensive and can reach large groups of people, especially when displayed in public places (e.g., public libraries).

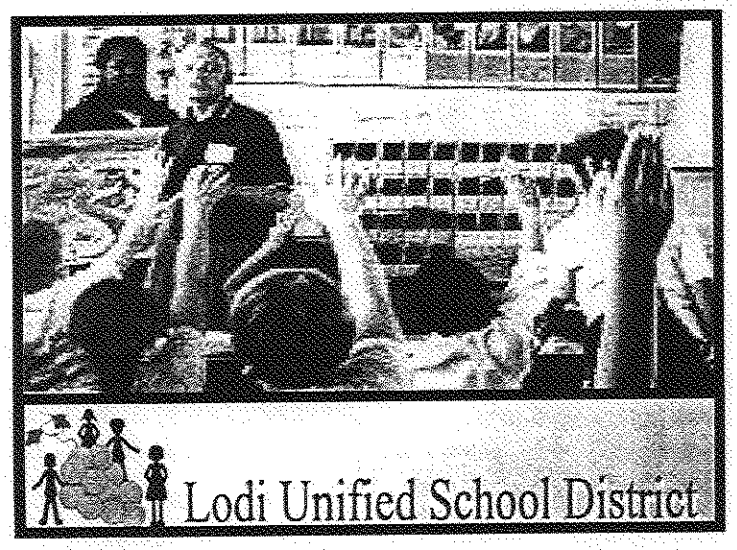
**Disadvantages:**
⇒ Care must be taken to ensure that the message is easily understood by the targeted audience.

**Applications:**
Educational displays, pamphlets, booklets, and stuffers can be easily exhibited and distributed to a large population. They can be made using simple materials and graphics, or they can be made more elaborate. Furthermore, these displays can be made for any and all age levels, in any language, or for specific audiences.

**Implementation:**
⇒ Pamphlets, booklets, and brochures are an effective way to present and explain a storm water message. Unlike many other communication vehicles, pamphlets and booklets can be distributed in many places without requiring someone to staff them. Racks of pamphlets can be set up at libraries, schools, offices, and fairs. They can be passed out at meetings and used in a direct mail campaign. Before creating a pamphlet or booklet, it is important to think through the purpose of the piece and its intended audience. It might be intended to solicit interest in a specific storm water event or activity, or to promote storm water education and positive behaviors. The purpose will significantly define the appearance and content.
⇒ In addition to a booklet or pamphlet, a one-page flyer can be produced to carry the basic message. A short, to-the-point flyer is essential as the primary education tool for programs with a small budget. Commonly, flyers list the basic do's and don'ts of water pollution and list the top 10 actions the public should take against storm water pollution. The flyer should contain the basic list of information the public needs to know. The flyer should be designed to be easily reproduced for newspapers and newsletters (black-and-white and reproducible by copy machine), a major venue for communicating with the public. The flyer can be designed as a self-mailer and as funds become available, it can be expanded into a poster, calendar, or booklet.
⇒ As with pamphlets, booklets, flyers, and utility stuffers offer an inexpensive, convenient way to convey the message to a large audience. However, instead of being targeted at a specific audience, utility stuffers must be appropriate for the public. These inserts can be extremely effective if they are engaging, concise, and memorable. They are often used to impart brief, important messages, provide overviews of the problems and solutions, or implore simple actions. When designing the insert, explore options regarding paper and ink colors, type faces, and type sizes; the text should be kept brief, the letters fairly large, and the design attractive. Special care should be taken to ensure that the message is simple, concisely written, and tells the reader why this issue is important to them.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Classroom Education




**Description:**
Classroom education is an integral part of any storm water pollution outreach program. Providing storm water education through schools exposes the message not only to students but to their parents as well. Many municipal storm water programs have partnered with educators and experts to develop storm water-related curricula for the classroom. In addition to formal lessons, activities such as poster contests can be initiated in the classrooms.

**Advantages:**
- ⇒ Children will learn about environmental issues early and will therefore become interested and perhaps involved at earlier ages.
- ⇒ Schoolchildren often tell their parents what they learn in school. Therefore, teaching children about storm water is an effective way to pass environmental awareness to their parents and throughout the entire community.
- ⇒ Activities like poster contests can simultaneously educate and inspire creativity.
- ⇒ Poster contest results can be posted in the community to educate adults as well as children.
- ⇒ Lessons need not be elaborate or expensive to be effective.

**Disadvantages:**
- ⇒ Incorporate storm water issues into the school curricula with so many subjects to teach is difficult as environmental issues might be viewed as less important.
- ⇒ Cost of new materials.
- ⇒ Effective activities must target the correct age group(s).

**Applications:**
Any school that wants to educate students about storm water.

**Implementation:**
- ⇒ Building a strong relationship with the school district is the most important step in getting storm water education into the schools. One of the first questions to ask is what storm water education program, if any, do the schools already implement, or want to see in their schools but lack the resources to do so. When developing an outreach message for children, choose the age ranges to target. Will the focus be on students in preschool, grammar school, middle school, and/or high school? Should the curricula be grade-level specific? Will the program involve a year-long study, a semester, a special topic or event, an art or writing contest, or a single presentation by an organization? What special equipment might be needed? For example, the municipality might purchase a small-scale watershed model that can be loaned to schools for demonstrations as part of a watershed education program. The answers to these questions and others will be determined by both the school district's needs and the municipal resources available.
- ⇒ Many national and regional organizations can provide assistance and materials for storm water education. The national Center for Environmental Education (CEE) was established in 1990 to provide teachers with a single clearinghouse for K–12 environmental education materials. CEE has written a guidebook titled *Blueprint for a Green School* to tackle the environmental challenges found inside schools and on school playgrounds. CEE's outreach department works with schools nationwide. One of the most popular programs, *Green School's Peer Partners in Environmental Education*, organizes high school students to adopt an elementary school or class. A free copy of the on-line program is available through Earth Spirit at 310-582-8228. CEE's Internet page at www.cee-ane.org is another good source of information.
- ⇒ If a school requests storm water outreach materials, municipalities can provide educational aids that range from simple photocopied handouts, overheads, posters, and slide shows, to more costly and elaborate endeavors such as working models and displays.

**Recommendation:**
Implementing a writing or art contest may be an effective way to educate a large number of adults and children. A contest could be initiated with an introductory lesson on storm water programs. Then if students are interested, they could enter the contest. A contest would inspire creativity, rewarding, educating, and fun. Furthermore, post-contest results could be displayed in the local newspaper or libraries, for example, and therefore educate many others. This type of education has the potential to reach all levels in the community through a single effort.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Catch Basin Marking


**Description:**
Storm drain labeling involves labeling storm drain inlets with painted messages warning citizens not to dump pollutants into the drains. The messages are generally a simple phrase to remind a passersby that the storm drains connect to local waterbodies and that dumping pollutes those waters. Some specify which waterbody the inlet drains into or names the particular river, lake, or bay. Common messages include: "No Dumping. Drains to Water Source," "Drains to River," and "You Dump it, You Drink it. No Waste Here." Pictures can also be used to convey the message, including a shrimp, common game fish, or a graphic depiction of the path from drain to waterbody.

**Advantages:**
- ⇒ Excellent opportunity to educate the public about the link between the storm drain system and drinking water quality.
- ⇒ Generally effective, inexpensive, and easy to implement.

**Disadvantages:**
- ⇒ Larger communities have many storm drain inlets, so volunteer coordinators need to be skilled at organizing to provide adequate coverage in large areas.
- ⇒ Safety considerations in areas where traffic congestion is high.
- ⇒ Environmental considerations from the use of propellants in spray paint.
- ⇒ Difficult to precisely measure the effect that storm drain stenciling programs have on human behavior.

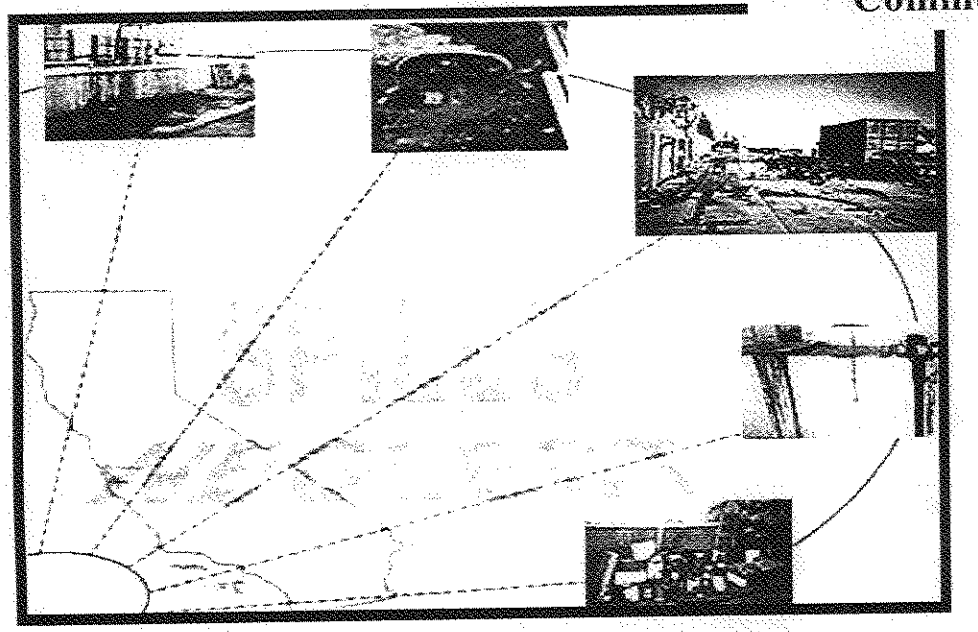
**Applications:**
Entire community, especially in areas with sensitive waters or where trash, nutrients, or biological oxygen demand have been identified as high priority pollutants. Areas where littering, nutrient overenrichment, and other practices that contribute to non-point source pollution is a problem.

**Implementation:**
Municipalities can implement storm drain stenciling programs in two ways. In some cases, cities and towns use their own public works staff to do the labeling. Some municipalities feel that having their own crews do the work produces better results and eliminates liability and safety concerns. More commonly, stenciling projects are conducted by volunteer groups in cooperation with a municipality. In such an arrangement, volunteer groups provide the labor and the municipality provides supplies, safety equipment, and a map and/or directions to the drains to be stenciled. The benefits of using volunteers are lower cost and increased public awareness of storm water pollutants and their path to waterbodies. A municipality can establish a program to comprehensively address storm drain stenciling and actively recruit volunteer groups to help, or the municipality can facilitate volunteer groups that take the initiative to undertake a stenciling project.

**City of Lodi Implementation:**
As an Eagle Scout project, about 60% of the existing storm drain catch basins have been labeled with placards indicating water is discharged to the river and that no dumping is allowed. Placards are shown at the upper left of this page. Newly installed catch basins include placards.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Community Hotline



**Description:**
Because regulators and authorities cannot monitor all waterbodies at once, they sometimes rely on the public to keep them informed of water polluters. Community hotlines provide a means for concerned citizens and agencies to contact the appropriate authority when they see water quality problems. A hotline can be a toll-free telephone number or an electronic form linked directly to a utility or government agency, such as the water quality control board. A typical call might report a leaking automobile, concrete wash-out dumped on the street, paint in a creek, or organic debris (including pet waste) in a drainage system or waterway.

**Advantages:**
⇒ Link between the citizens and the municipality's government. It can be an avenue for citizens to feel more involved in their community.
⇒ Can catch illegal polluters or stop spills that might otherwise go unnoticed.

**Disadvantages:**
⇒ Community must be able to pay for hotline and keep the hotline staffed.
⇒ Hotline must be advertised in order for the effort to be successful.

**Effectiveness:**
A storm water hotline is effective when its number is easily remembered (i.e., has a catchy name) or is easily accessible. Most important, however, is the responsiveness of the hotline. If a citizen reports an illegal dumping but no action is taken by the appropriate authority, that citizen could lose faith in the hotline and might not call back with future information.

**Applicability:**
Generally, an investigation team promptly responds to a hotline call and, in most cases, visits the problem site. If a responsible party can be identified, the team informs the party of the problem, offers alternatives for future disposal, and instructs the party to resolve the problem. If the issue is not resolved by the responsible party (or the party cannot be identified), the proper authority takes action to remediate the situation and prevent future violations.

**Implementation:**
A municipality must first determine whether they need a hotline and, if so, whether the hotline is needed immediately or in the near future. A city can identify their need for a hotline by addressing the following questions:

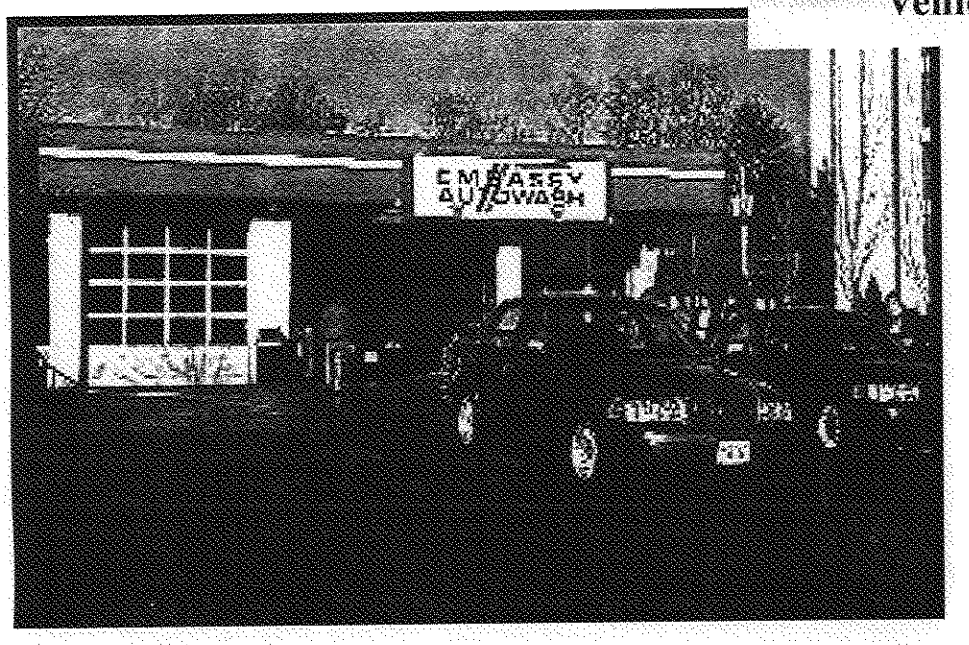
- Does the city receive frequent phone calls for information about water bodies and stream pollution?
- Are there frequent complaints?
- Are there any anticipated construction or other projects in the city?
- Are there any new ordinances or regulations?
- Does the city currently use a "hit or miss approach," in which whoever picks up the phone deals with the situation?

Once a city has determined that they need a hotline, they should choose between a telephone or an e-mail hotline.

⇒ To establish a storm water pollution hotline, a party or agency responsible for maintaining the hotline and responding to incoming complaints must first be identified. The responsible party could be a division of local government, a water quality board, a public utility, or an environmental agency. If the city chooses to use its own staff, it should keep in mind that the staff will require training. The city could also contract with a professional hotline provider. Once the party has agreed to maintain the hotline, it will need to establish a telephone number (preferably toll-free and to be used solely to report pollution complaints) and/or Internet site to receive notification.
⇒ All distributed materials should include pollution hotline numbers and information. Typically, hotlines are advertised on public education materials concerned with water quality, such as flyers, door hangers, and brochures. The hotline could also be publicized on "permanent" materials such as bumper stickers and refrigerator magnets, where the number can be retained and easily located.
⇒ Hotline costs can be minimized by staying a step ahead of questions and by developing close liaison with city staff to anticipate information needs. Cost estimates can be obtained by comparing the costs of training city staff and using a professional hotline service.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Vehicle Washing




**Description:**
This management practice involves educating the general public, businesses, and municipal fleets (public works, school buses, fire, police, and parks) on the water quality impacts of the outdoor washing of automobiles and how to avoid allowing polluted runoff to enter the storm drain system. Outdoor car washing has the potential to input high loads of nutrients, metals, and hydrocarbons to watersheds during dry weather conditions, as the detergent-rich water used to wash the cars flows into the storm drain. Commercial car wash facilities often recycle their water or are required to treat their wash water discharge prior to release to the sanitary sewer system. Most storm water impacts from car washing are caused by residents, businesses, and charity car wash fundraisers that discharge polluted wash water to the storm drain system. According to the surveys, 55 to 70 percent of households wash their own cars, with the remainder going to a commercial car wash.

**Limitations:**
⇒ Lack of knowledge regarding the impacts of polluted runoff. Many people do not associate the effects of their vehicle washing activities with local water quality and may be unaware that the discharges that enter storm drains are not treated at plants before being discharged into local waters.
⇒ Construction of a specialized area for vehicle washing can be expensive. Also, for facilities that cannot recycle their wash water, pretreating wash water, through either structural practices or planning for collection and hauling of contaminated water to sewage treatment plants, can represent a cost limitation.

**Applicability:**
Car washing is a common routine for residents and a popular way for organizations such as scout troops, schools, and sports teams to raise funds. This activity's impact on water quality is greatest in more urbanized areas with higher concentrations of automobiles. Carwash fundraisers are popular in Lodi and are of particular concern for the City.

**Implementation:**
The development of a prevention program to reduce the impact of car wash runoff includes outreach on management practices to reduce discharges to storm drains. Some of these management practices include the following:

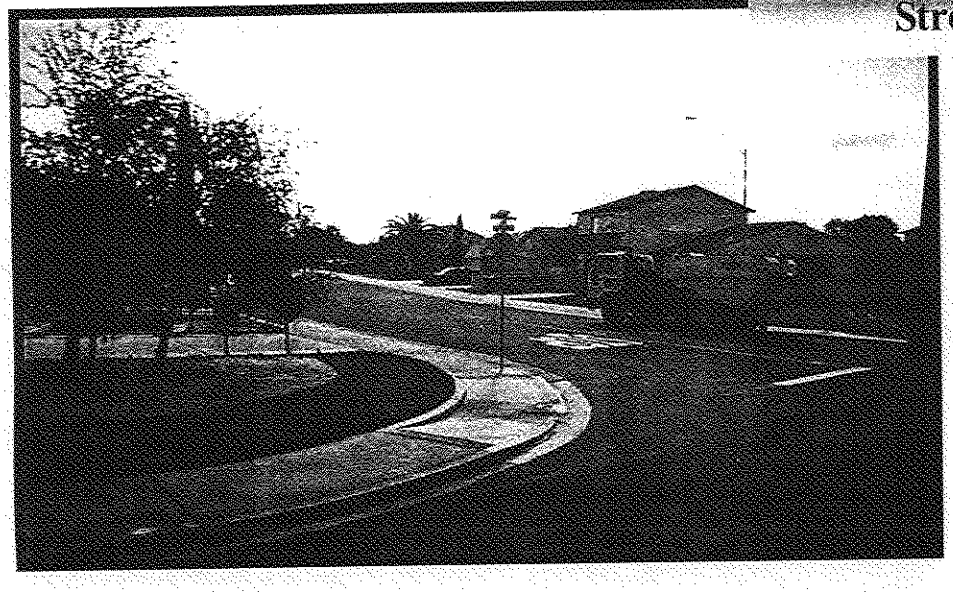
- Using a commercial car wash.
- Washing cars on gravel, grass, or other permeable surfaces.
- Blocking off the storm drain during charity carwash events or using an insert to catch wash water.
- Directing soapy water from car washes to sanitary sewer drains.
- If pumping into a drain is not feasible, pumping car wash water onto grass or landscaping to provide filtration.
- Using hoses with nozzles that automatically turn off when left unattended.
- Using only biodegradable soaps.

⇒ Storm drain stenciling programs emphasizing the connection between the storm drain system and runoff can also help reinforce the idea that car washing activities can affect local water quality.
⇒ In the Pacific Northwest, outreach programs provide materials to charity carwash organizers to prevent car wash water from entering storm drains. These "water friendly "carwash kits are provided free of charge to charity organizers, along with training and educational videos on planning an environmentally friendly carwash. Two types of equipment are available for charity organizations to borrow: a catch-basin insert with a sump pump, or a vacuum/boom device known as a Bubble Buster. Both devices capture wash water runoff, allowing it to be pumped to either a sanitary sewer or a vegetated area for treatment.

**Effectiveness:**
The effectiveness of car washing management practices at reducing nonpoint source pollutant loads has yet to be measured accurately. Due to the diffuse nature of nonpoint source pollution, it is often difficult to determine the exact impact of a particular pollution prevention measure at reducing pollutant loading

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Street Cleaning



**Description:**
This management practice involves employing pavement cleaning such as street sweeping on a regular basis to minimize pollutant export to receiving waters. These cleaning practices are designed to remove sediment debris and other pollutants that are a potential source of pollution impacting urban waterways. Although performance monitoring for the Nationwide Urban Runoff Program (NURP) indicted that street sweeping was not very effective in reducing pollutant loads, recent improvements in street sweeper technology have enhanced the ability of present day machines to pick up the fine grained sediment particles that carry a substantial portion of the storm water pollutant load. Many of today's sweepers can now significantly reduce the amount of street dirt entering streams and rivers, some by significant amounts. A debate as to whether this ability to pick up finer particles will improve the overall pollutant removal effectiveness of street sweepers is ongoing, and further research is required to establish the optimal sweeping frequency for pollutant removal.

**Disadvantages:**
- ⇒ The high cost of some of the newer sweeper technologies is approaching $200,000.
- ⇒ The potential inability to restrict parking in urban areas.
- ⇒ The need for sweeper operator training, the inability of current sweeper technology to remove oil and grease, and the lack of solid evidence regarding the level of pollutant removal.

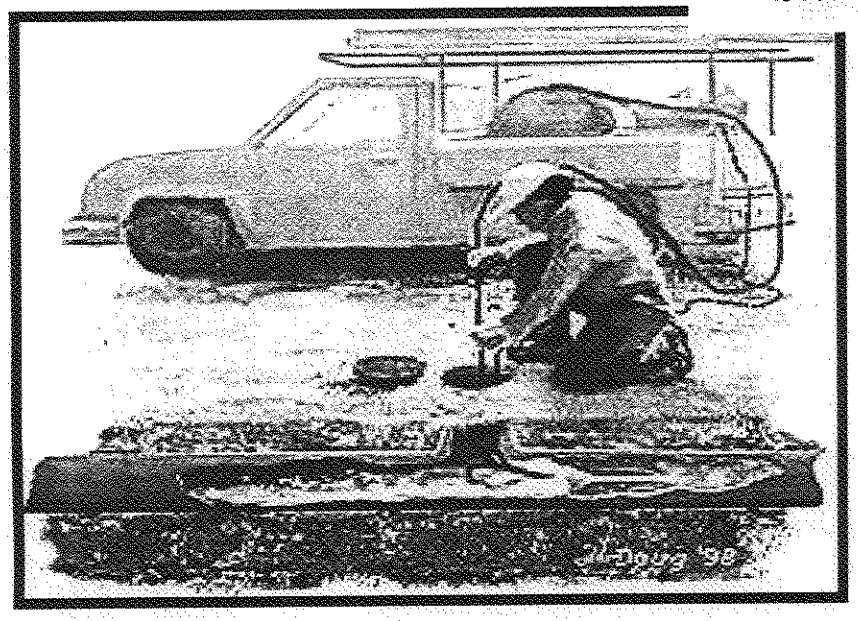
**Applicability:**
Most urban areas. The frequency and intensity of rainfall for a region is a key variable in determining how streets need to be swept to obtain a desired removal efficiency. Other factors that affect a street sweeper's ability to reduce nonpoint pollution include the condition of the street, its geographical location, the operator's skill, the presence of parked cars, and the amount of impervious area devoted to rooftops.

**Design Considerations:**
- ⇒ One factor considered most essential to the success of street sweeping as a pollutant removal practice is the use of the most sophisticated sweepers available. Innovations in sweeper technology have improved the performance of these machines at removing finer sediment particles, especially for machines that use vacuum-assisted dry sweeping to remove particulate matter. By using the most sophisticated sweepers in areas with the highest pollutant loads, greater reductions in sediment and accompanied pollutants can be realized.
- ⇒ Another important aspect of street sweeping programs is the ability to regulate parking. The ability to impose parking regulations in densely populated areas and on heavily traveled roads is essential.
- ⇒ The frequency and location of street sweeping is another consideration for any program. How often and what roads to sweep are determined by the program budget and the level of pollutant removal the program wishes to achieve. Computer modeling of pollutant removal in the Pacific Northwest suggests that the optimum sweeping frequency appears to be once every week or two. More frequent sweeping operations yielded only a small increment in additional removal. The model also suggests that a somewhat higher removal rate could be obtained on residential streets as opposed to more heavily traveled arterial roads.
- ⇒ Parking lot sweeping is also employed as a nonstructural management practice for industrial sites. This involves using brooms to remove small quantities of dry chemicals and solids from areas that are exposed to rainfall or storm water runoff. While the effectiveness of this pollutant removal is unknown, the sweeping and proper disposal of materials is a reasonably inexpensive method that requires no special training or equipment.

**Maintenance:**
Street cleaning programs require a significant investment of capital and a yearly operation and maintenance budget. Sweepers have a useful life of about four years, and proper maintenance can greatly improve sweeping efficiency. Arrangements for disposal of the swept material collected must also be made, as well as accurate tracking of the streets swept and the frequency of sweeping.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Storm Drain Cleaning



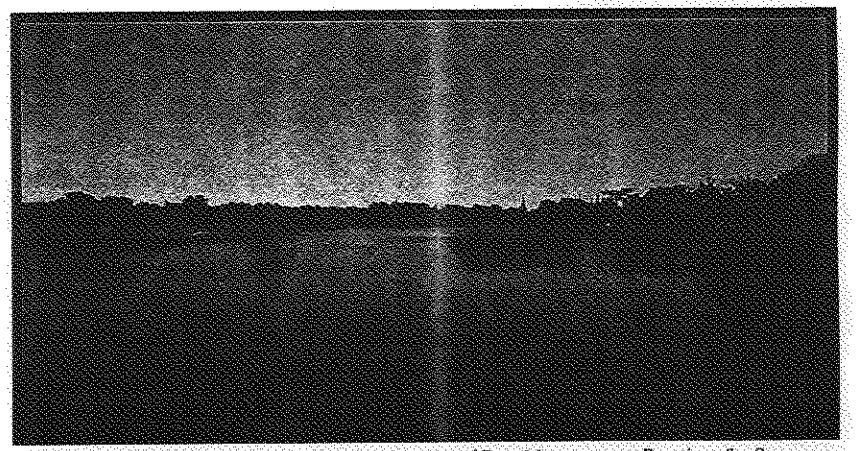
**Description:**
Storm drain systems need to be cleaned regularly to maintain their ability to trap sediment, and consequently their ability to prevent flooding. Most drains have catch basins built at the curb line which allow surface water runoff to enter the storm water conveyance system. Many catch basins have a low area below the invert of the outlet pipe intended to catch coarse sediment. By trapping sediment, the catch basin prevents solids from clogging the storm sewer and being washed into receiving waters. Routine cleaning reduces the amount of pollutants, trash, and debris both in the storm drain system and in receiving waters. Clogged drains and storm drain inlets can cause the drains to overflow, leading to increased erosion.

**Advantages:**
⇒ Better drainage will reduce large-scale maintenance and repairs.
⇒ Improvement of aesthetics and water quality. Increase of dissolved oxygen, reduction of bacteria levels, reduction of odor, and support of instream habitat.
⇒ Efficient and cost-effective method for preventing the transport of sediment and pollutants to receiving water bodies.

**Disadvantages:**
⇒ Removed debris usually contains appreciable amounts of water and offensive organic material which must be properly disposed.
⇒ Difficult to clean in areas with poor accessibility or traffic congestion.
⇒ The efficiency of storm system flushing decreases when the length of sewer line being cleaned exceeds 700 feet.
⇒ A water source is necessary for cleaning.

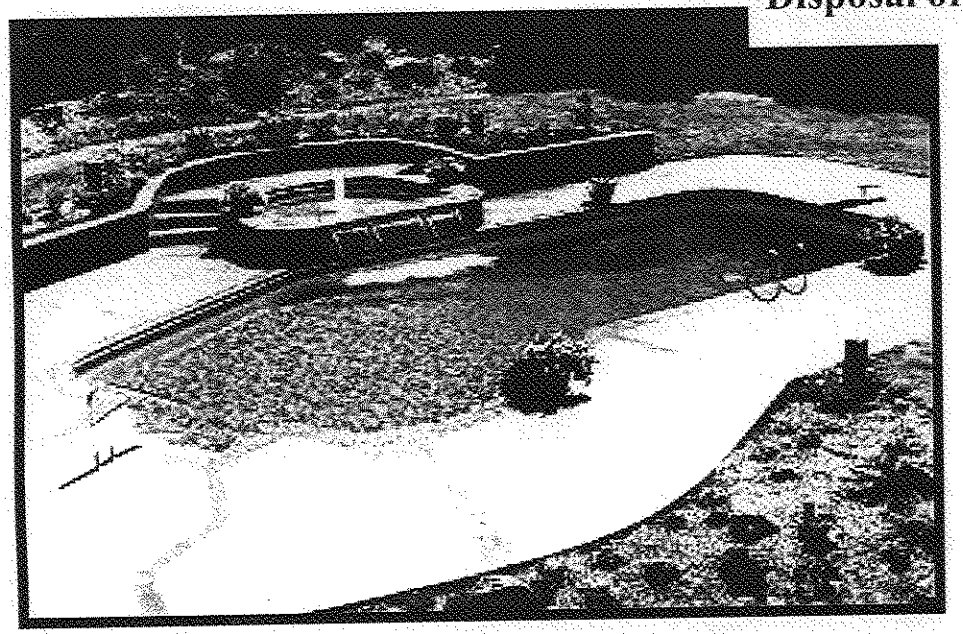
**Applicability:**
This measure is applicable to all storm drain systems. The same principles can be applied to material and waste handling areas, paved and vegetated areas, waterways, and new development projects. Areas with relatively flat grades or low flows should be given special attention because they rarely achieve high enough flows to flush themselves. Many programs tend to focus only on removal of debris from grate openings, but a full implementation of this BMP should also include removal of debris from the catch basin itself.

**Maintenance:**
⇒ Must remove 55 to 65 percent of inorganic materials and grits and 65 to 75 percent of organics.
⇒ Catch basins should be inspected at least annually to determine if they need to be cleaned. Typically, a catch basin should be cleaned if the depth of deposits is greater than or equal to one-third the depth from the basin to invert of the lowest pipe or opening into or out of the basin. If a catch basin significantly exceeds the one-third depth standard during the annual inspection, then it should be cleaned more frequently. If woody debris or trash accumulates in the basin, then cleaning should be weekly.
⇒ Catch basins can be cleaned manually or with specially designed equipment like bucket loaders and vacuum pumps. Removed material can usually be disposed in conventional landfills. However, before any materials can be disposed, it may necessary to perform a detailed chemical analysis to determine if the materials meet the EPA criteria for hazardous waste.



Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Disposal of Chlorinated Water



**Description:**
Chlorinated water discharged to surface waters has an adverse impact on local water quality. Swimming pools are a major source of chlorinated water discharged into sanitary and storm sewer systems. An average swimming pool holds 19,000 gallons of chlorinated water. Pools have high concentrations of chlorine, which is toxic to wildlife and fish. Proper disposal of chlorinated water can include dechlorination before discharge and/or discharge to the sanitary sewer system or land.

**Advantages:**
⇒ A safe discharge of chlorinated water will improve water quality for fish and wildlife.

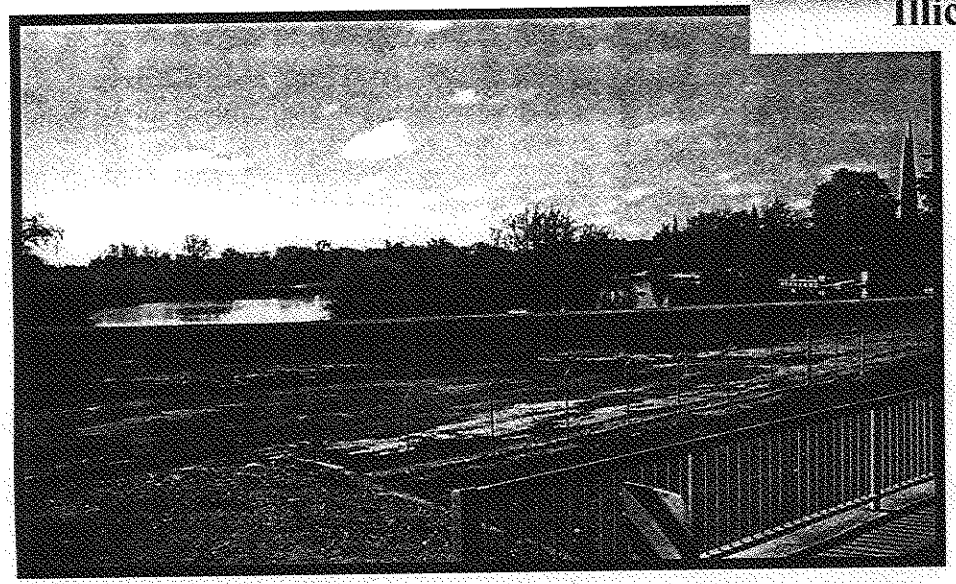
**Limitations:**
⇒ Enforcement of safe discharge of chlorinated water may be difficult to achieve.

**Applicability:**
⇒ Any chlorinated pool owner should investigate these alternative discharge options.
⇒ Many pool owners who live in cooler climates drain their swimming pools to reduce maintenance and potential damage from freezing during harsh winters. These individuals should not discharge pool water to the storm sewer system or directly into a water body and should investigate alternative discharge options.

**Implementation:**
⇒ Requires pool owners to obtain permission from local sanitary sewer operators or municipal treatment plant operators to discharge to the sanitary sewer system using a surge tank.
⇒ Discharge the chlorinated water to land where it will not drain to local surface waters.
⇒ Dechlorinate the water before draining the pool.
⇒ If the only option for draining pool water is to discharge directly into the environment, water quality must comply with the applicable water quality criteria.
⇒ Pool water must sit for at least 2 days after the addition of chlorine or bromine or until chlorine or bromine levels are below 0.1 mg/l.
⇒ The pH of discharged water must be between 6.5 and 8.5 before it is discharged.
⇒ Algicides such as copper or silver can interrupt normal algal and plant growth and should not be used.
⇒ Total suspended solids must be below 60 mg/l—suspended particles should be allowed to settle out and the water should not appear murky. Settled material should not be discharged with pool water.
⇒ Discharges to the environment should be directed over a land surface so that some level of filtration by soil particles can occur. The above water quality requirements also apply to land-applied water.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Illicit Discharge



**Procedures for Removing the Source of an Illicit Discharge**

⇒ Issue hefty fines as a penalty to illicit dischargers (if they are identifiable.)

⇒ Continue to educate public, local businesses, in addition to identified illicit dischargers about the storm water drainage system. Inform them of the hazards associated with illegal discharges and improper disposal of waste. Provide ways for them to prevent illicit discharges.

⇒ Clean up floatable debris using methods found on BMP entitled: "Methods for Floatable Debris Control."

**Procedures for Program Evaluation and Assessment**

⇒ Conduct follow-up field tests periodically to monitor amount of illicit discharge. These tests will reveal whether or not the program has helped improve the storm drain water quality.

The objective of an illicit discharge investigation program is to identify and eliminate the discharge of pollutants to the storm water drainage system. Identifying illicit connections and major sources of floatable debris are key to reducing illicit discharge. Controlling illicit discharge provides important public health benefits as well as lotic ecosystem protection. However, regulating practices like illegal dumping is difficult because of its covert nature.

**Procedures for Locating Priority Areas Likely to Have Illicit Discharges**

⇒ Visually screen outfalls during dry weather.

⇒ Conduct field tests of selected pollutants as part of locating priority areas.

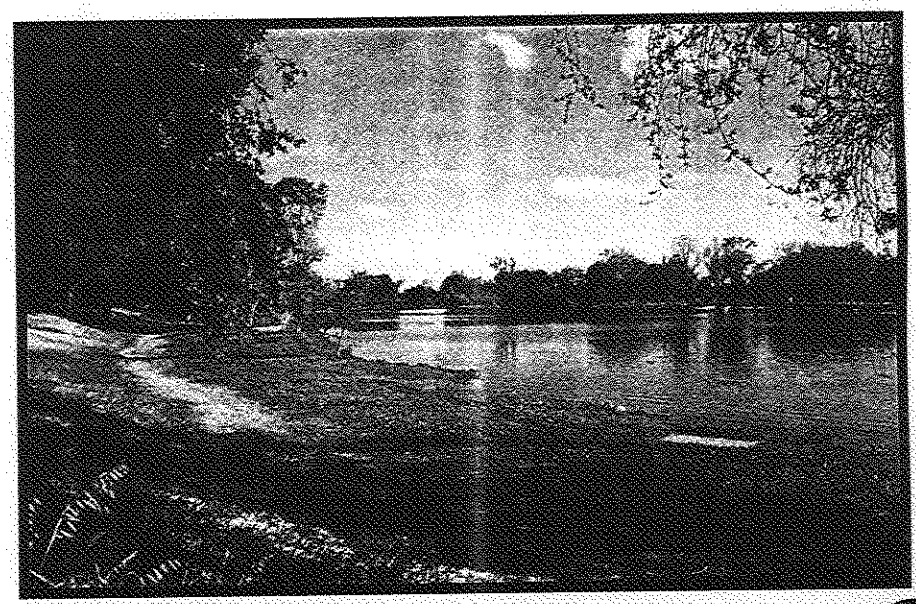
⇒ Generate a storm sewer system map, showing the location of all outfalls and the names and location of all waters that receive discharges from those outfalls.

**Procedures for Tracing the Source of an Illicit Discharge**

⇒ Again, use the map to locate outfalls where the majority of illicit discharge is found.

⇒ Identify illicit connections to the storm drain system. (See BMP entitled "Illicit Connections").

⇒ Conduct field tests to evaluate the type of illicit discharge and attempt to link to source. For example, if a great deal of floatable debris displays the same company name, then investigate that company as a potential illicit discharge source. (See BMP entitled "Floatable Debris").



# Location of Illicit Discharges: Illicit Connections

**Description:**
Illicit connections are defined as illegal connections to storm drainage systems. A discharge of industrial wastewater to a storm sewer is "illicit" because it would ordinarily require a permit under the Clean Water Act. Many building owners or operators are not aware that improper connections exist in their facilities. Identifying and removing illicit connections is a measure for reducing storm water pollution. In extreme cases of illicit dumping, legal action is necessary.

**Advantages:**
⇒ Effect method to reduce the quantity of industrial or commercial pollutants that enter the storm drain system.

**Disadvantages:**
⇒ The cost of smoke testing, dye testing, visual inspection, and flow monitoring can be significant and time-consuming.
⇒ A local ordinance is necessary to provide investigators with access to private property in order to perform field tests
⇒ Rain fall can hamper efforts to monitor flows and visual inspections. In addition, smoke testing and dye testing may become more difficult, depending on the severity of the storm event. Smoke testing has roughly the same efficiency as door-to-door investigation, and both smoke and dye testing are more accurate than visual inspection.

**Applications:**
Identifying illicit and improper connections are necessary for all sewer systems, especially in areas where pollutants with unknown sources have been detected in receiving waters.

**Implementation:**
⇒ Institute building and plumbing codes to prevent connections of potentially hazardous pollutants to storm drains.
⇒ Organize structures to be inspected by building age, with older buildings identified as priorities. Buildings whose processes have the potential to affect water quality also should be given priority.
⇒ Map each area to be surveyed and indicate the route of the sewer system and the locations of storm drains on the map. This enables planners to estimate the likely locations of illicit connections. A Geographic Information System (GIS) is an appropriate tool for identifying illicit discharges. The location of illicit discharges can be maintained by a geo-coded address. The attributes for illicit discharges are Standard Industrial Code (SIC) code, owner/occupant information, inspection schedule, inspection dates, and comments.
⇒ Survey individual buildings to discover where connections to storm drains exist.
⇒ Inspect sewer lines with television equipment to visually identify all physical connections.
⇒ Compare the results of the field tests and the video inspection with the known connections on the map. Suspicious areas should be further investigated.
⇒ Institute mandatory inspections for new developments or remodeling to identify illicit connections to the storm sewer system.
⇒ Remove and test sediment from the catch basins or equivalent structures.
⇒ Inspect connections in question to determine whether they should be connected to the storm drain system or to the sanitary sewer. Use methods of identification such as dye testing, visual inspection, smoke testing, or flow monitoring, as described below.

**Maintenance:**
⇒ Identify illicit discharges with teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system. Take baseline samples throughout the city so that future illicit discharge pollution identification efforts can be better established.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Specific Methods for Detecting Illicit Connections

⇒ **Dye Testing.** Flushing fluorometric dye into suspicious downspouts can be useful to identify illicit connections. Once the dye has been introduced into the storm system via the connection in question, the water in the collection system is monitored to determine whether an illicit connection is present.

⇒ **Visual Inspection.** Remotely guiding television cameras through sewer lines is another way to identify physical connections.

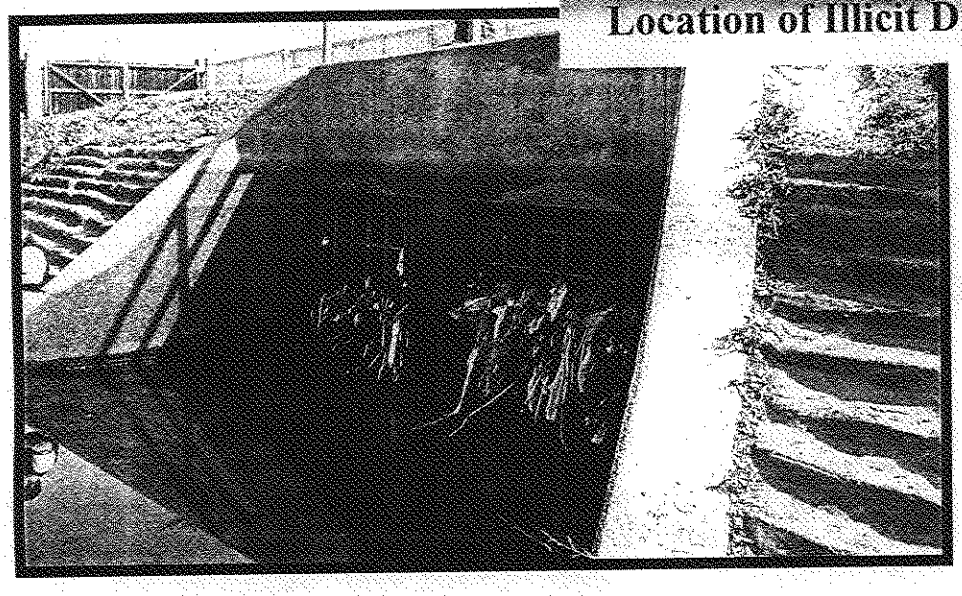
⇒ **Smoke Testing.** Smoke testing is another method used to discover illicit connections. Zinc chloride smoke is injected into the sewer line and emerges via vents on connected buildings or through cracks or leaks in the sewer line. Monitoring and recording where the smoke emerges, crews can identify all connections, legal and illegal, to the sewer system. Mechanisms on drains should prevent the smoke from entering buildings; however, in some instances, this will occur. It is important to notify the public that the smoke is non-toxic, though it should be avoided as it can cause irritation of the nose and throat for some people.

⇒ **Flow Monitoring.** Monitoring increases in storm sewer flows during dry periods can also lead investigators to sources of infiltration due to improper connections.

⇒ **Infrared, Aerial, and Thermal Photography.** Researchers are experimenting with the use of aerial, infrared, and thermal photography to locate dischargers by studying the temperature of the stream water in areas where algae might be concentrated and in soils. It also examines land surface moisture and vegetative growth. This technique assumes that a failing Onsite Disposal System (OSDS), for example, would have more moisture in the surface soil, the area would be warmer, and the vegetation would grow faster than in the surrounding area.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Location of Illicit Discharges: Floatable Debris



**Description:**
Identifying the source of floatable material in stormwater is key to developing a program to control it. By expanding existing programs the City can attempt to track floatable debris to its source.

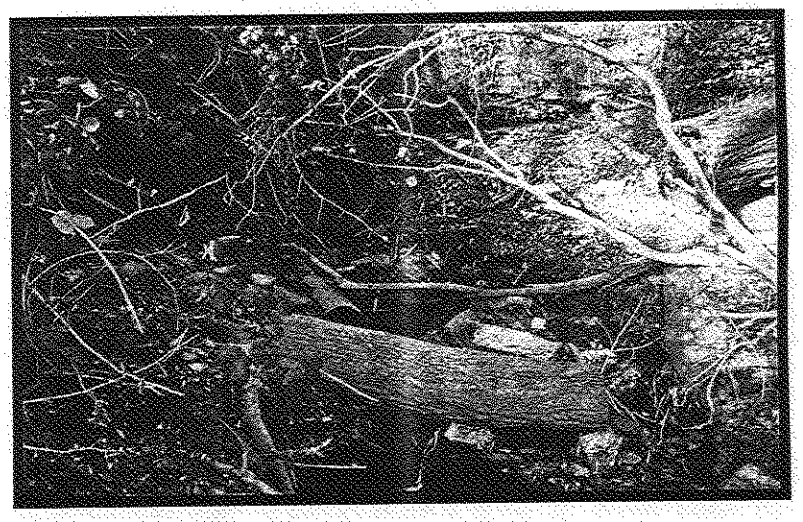
Clogged drains and storm drain inlets can cause the drains to overflow, leading to increased erosion. Benefits of cleaning include increased dissolved oxygen, reduced levels of bacteria, and support of instream habitat. Areas with relatively flat grades or low flows should be given special attention because they rarely achieve high enough flows to flush themselves.

**Advantages:**
⇒ Improved storm water drainage.
⇒ Educates high school students and the community while generating useful information for the program.

**Disadvantages:**
⇒ High cost of program materials and monitoring.
⇒ Difficult to control the use of floatable material.
⇒ May be difficult to find high schools interested in participating in the program.
⇒ Illegal dumping is often spurred by cost and convenience considerations, and a number of factors encourage this practice. The cost of fees for dumping at a proper waste disposal facility are often more than the fine for an illegal dumping offense, thereby discouraging people from complying with the law.

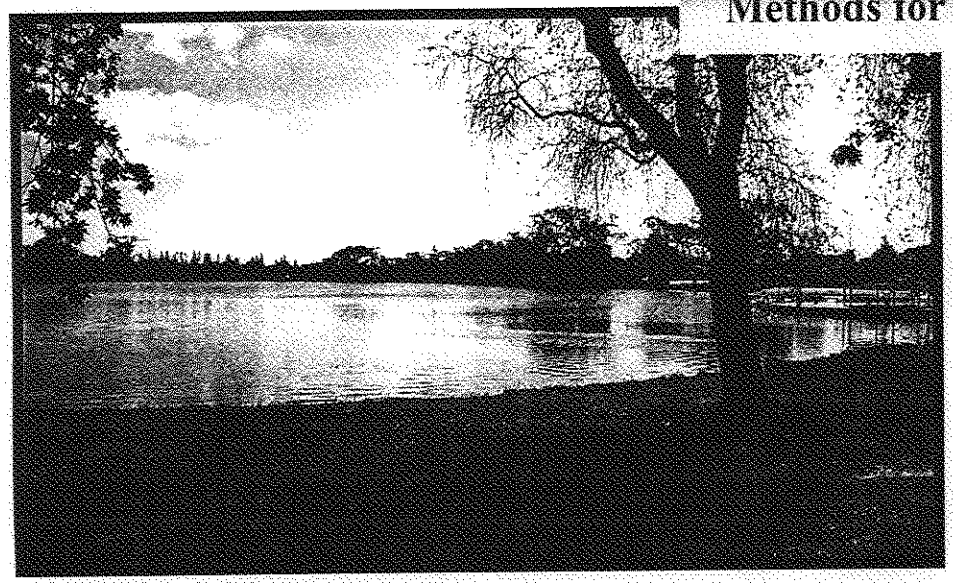
**Applicability:**
⇒ Areas with heavier rainfall, due to the greater volume of runoff.
⇒ In more urbanized areas, where illegal dumping may occur due to inaccessibility of recycling or solid waste disposal centers, which are often located on the suburban-rural fringe.

**Implementation:**
⇒ Utilize the Storm Drain Detectives Program in which high school students conduct a floatable debris characterization study to identify specifically what the debris in the stream consists of (i.e., 20% Styrofoam cups, 30% fast food wrappers, 10% empty soda cans or bottles, etc.). A drainage system inventory would be conducted to locate the most severe problem (i.e., downstream of parks, schools, fast food restaurants, etc.). This inventory would be based on volume collected during a set period of time.
⇒ Evaluate source control strategy options.
⇒ Increase frequency of trash collection at specific locations.
⇒ Change City codes and ordinances to restrict use of floatable materials if a specific segment of the community can be identified as causing a disproportionate share of the problem.
⇒ Modify catch-basin inlet design to include a screen that will prevent floatable debris from entering the piped conveyance system.
⇒ Consider end-of-pipe separators (i.e., swirl concentrators).



Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm

# Methods for Floatable Debris Control



**Source Control:**

⇒ The obvious first step in source control is to prevent trash from entering the drains to become floatable debris. This prevention measure requires public education about the stormwater drainage system. To further encourage proper disposal, additional trash cans may be installed in public areas to provide additional places of disposal other than the stormwater drains.

⇒ Bar screens and other filter type devices installed at the entrance and exit of the stormwater drain prevent some debris from continuing to the outfall. For example, the FloGard+PLUS (manufactured by KriStar Enterprises) fits in storm drains to capture sediment, debris, trash, oils and grease. This device can accommodate low, high, and sustained high flows while continuing to retain collected pollutants.

⇒ Consider installing pipe outlet covers on pipes at the outlet of sumped catch basins to stop both free-oil and floatable debris. An example is the SNOUT Stormwater Quality Improvement System (manufactured by Best Management Products, Inc.) that consists of a plastic hood that covers the outlet of the pipe.

⇒ Street sweeping, which is developed in another BMP, helps reduce the amount of refuse that ends up in the drainage system.

⇒ Encourage community members to recycle yard waste such as grass clippings by leaving them on their lawns instead up dumping.

**End-of-Pipe Control:**
**Consider installing...**

⇒ **Swirl Concentrators.** The flow into the concentrator causes a swirling motion around the removal chamber which encourages sedimentation. Units are typically sized to achieve an average of 80 percent removal of TSS over time. These devices are installed in underground vaults to effectively treat stormwater by removing and retaining sediments and floatables from site runoff. Specific products include V2B1, Vortechs, and Downstream Defender.

⇒ **Wet Vaults.** Wet vaults collect and hold floatable debris, bed load material, free oil and grease, settleable sediments and those dissolved pollutants including metals, nitrogen and phosphorous nutrients, and soluble organic compounds. The collected contaminants are retained by the system until they are removed by routine maintenance. Systems like the Jensen or Teichert Interceptor consist of rectangular concrete vaults that are typically multi-chambered with interior chambers separated by baffle walls. Units should be sized based on settling of particles. Other manufacturers such as BaySaver and Stormceptor design round wet vaults. All of these manufacturers produce several models with a range of flow capacities.

⇒ **Media Filters.** Media filters are vertical cylinders with a unit capacity of 15 gpm. Multiple cylinders can be used to accommodate the desired system capacity. These cylinders are placed in line, in a vault. Water enters radially through the filter media into an inner cylinder. The filtered water passes downward to an underlain system that is contained in the bottom slab. Media filters can maximize the flow-through rate as each cylinder contains a simple, non-mechanical vacuum device that prevents water from flowing through the cylinder until the water has risen to the top of the cylinder. Primary constituents targeted for removal include dissolved metals and nutrients. Filters can be effective where land is at a premium, but they do require regular maintenance. When filters are undersized or left unmaintained, fine sediment accumulates on their surface and clogs the filter. Stormwater Management markets a filter called a StormFilter.

⇒ **Deflection Screens.** Deflection screens are similar to swirl concentrators in that they have a circular removal chamber and flow moves in a circular motion. However, vortex separation is not induced with a deflection screen. Instead removal is accomplished with a screen located around the outer perimeter of the removal chamber. Settleable solids drop at the interface of the screen while the floatables pass upward. The hydraulic action in this device prevents clogging of the screen. CDS (Continuous Deflective Separation) Technologies currently manufactures this device.

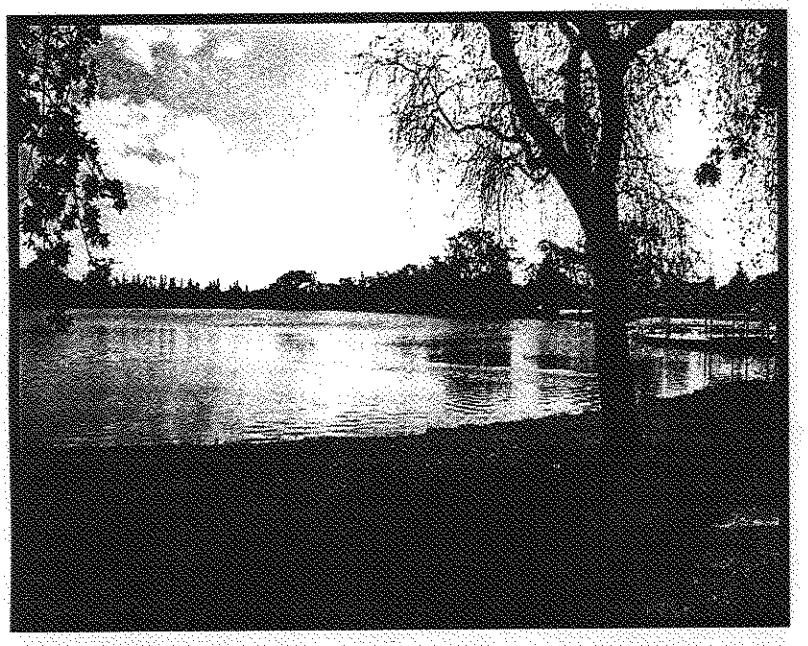
⇒ **Check Valves.** Consider installing check valves (like the Tideflex manufactured by Red Valve Company, Inc.) to prevent backflow from washing collected floatable debris out of catchments, racks or screens. A check valve must be used in conjunction with a floatable collection system.

# Table of Methods for Floatable Debris Control

| Type of Device | Product | Company | Product Description | Target Constituents |
|---|---|---|---|---|
| Wet Vault | Jensen Interceptor | Jensen Precast | Multiple chambers in series separated by baffles. Contains standing water, or dead storage, which enhances treatment. | Settleable and floatable solids, oil/ grease and particulate pollutants. |
| Wet Vault | Teichert Interceptor | Teichert Precast | Multiple chambers in series separated by baffles. Contains standing water, or dead storage, which enhances treatment. | Settleable and floatable solids, oil/ grease and particulate pollutants. |
| Wet Vault | BaySaver | BaySaver, Inc. | Two standard manholes. One for removal of sediment and separation of floatables which are diverted by a special device into the other manhole for storage. Diversion device passes extreme flows through the unit. | Settleable and floatable solids, oil/ grease and particulate pollutants. |
| Wet Vault | Stormceptor | CSR Hydro Conduit | A weir insert placed in a round manhole vault to improve hydraulics thereby improving removal efficiency and retention of sediment. Device can handle low and high flows. | Settleable and floatable solids, oil/ grease and particulate pollutants. |
| Swirl Concentrator | Downstream Defender | H.I.L. Technology, Inc. | Uses vortex separation with device installed in a round single manhole vault. | Settleable and floatable solids, oil/ grease and particulate pollutants. |
| Swirl Concentrator | Vortechs | Vortechnics | Vortex separation with the swirl device placed in a rectangular, shallow vault. Comes in nine standard sizes. | Settleable and floatable solids, oil/ grease and particulate pollutants. |
| Swirl Concentrator | V2B1 | Vistner Concrete | Two manholes in series. Vortex separation removes particulates and floatables in first manhole. Floatables move to a chamber in the second manhole for storage. Diverter in first manhole bypasses high flows on opposite sides of the screen which also prevents clogging of the screen. | Settleable and floatable solids, oil/ grease and particulate pollutants. |
| Deflection Screen | CDS (Continuous Deflective Separation) | CDS Technologies | Circular device in which flow is directed to create circular flows like a vortex. Removal occurs as the water passes through a screen around the outer perimeter. Removal induced by countercurrent flows on opposite sides of the screen which also prevents clogging of the screen. | Settleable and floatable solids, oil/ grease and particulate pollutants. |
| Media Filter | StormFilter | Stormwater Management | Vertical cylinder with media of various types placed in the cylinder. Water enters laterally through the filter, enters a vertical center well which exits to an underdrain system. Number of cylinders is a function of design peak flow. | Varies with media. All reduce settleable solids. Some remove dissolved nutrients or dissolved metals. |
| Check Valve | Tideflex | Red Valve Company, Inc. | Used in conjunction with a floatable collection system, a check valve prevents backflow from washing collected debris out of catchments. | Floatable debris |
| Bar Screen | FloGard+PLUS | KriStar Enterprises | Fits in storm drain to collect pollutants. This device accommodates low, high, and sustained high flows. | Sediment, debris, trash, oils and grease. |
| Pipe Outlet Cover | SNOUT Stormwater Quality Improvement System | Best Management Products, Inc. | Plastic hood that covers pipe outlet of sumped catch basins. | Floatable debris and free-oil. |

Source: Sacramento Stormwater Management Program. "Investigation of Structural Control Measures for New Development." Prepared by Larry Walker Assoc., Nov. 1999.

# Ordinance



**Description:**
The management of storm water runoff from sites after the construction phase is vital to controlling the impacts of development on urban water quality. The increase in impervious surfaces such as rooftops, roads, parking lots, and sidewalks due to land development can have a detrimental effect on aquatic systems. Heightened levels of impervious cover have been associated with stream warming and loss of aquatic biodiversity in urban areas. Runoff from impervious areas can also contain a variety of pollutants that are detrimental to water quality, including sediment, nutrients, road salts, heavy metals, pathogenic bacteria, and petroleum hydrocarbons.
An ordinance promotes the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any development or other activity that disturbs or breaks the topsoil or results in the movement of earth on land. The goal of a storm water management ordinance for postconstruction runoff is to limit surface runoff volumes and reduce water runoff pollutant loadings.

**Benefits:**
⇒ Minimize the increase in storm water runoff from any development to reduce flooding, siltation, and streambank erosion and to maintain the integrity of stream channels.
⇒ Minimize the increase in nonpoint source pollution caused by storm water runoff from development that would otherwise degrade local water quality.
⇒ Minimize the total annual volume of surface water runoff that flows from any specific site during and following development so as not to exceed the predevelopment hydrologic regime to the maximum extent practicable.
⇒ Reduce storm water runoff rates and volumes, soil erosion, and nonpoint source pollution, wherever possible, through storm water management controls. Ensure that these management controls are properly maintained and pose no threat to public safety.

**Limitations:**
⇒ Site inspections are required for a postconstruction storm water ordinance to be effective.
An adequate staff must be available to review permit applications and proposed plans.

**Applicability:**
These ordinances are applicable to all major subdivisions in a municipality. The size of the development to which postconstruction storm water management runoff control applies varies, but many communities opt for a size limit of 5,000 square feet or more. Applicability should be addressed in more detail in the ordinance itself. It is important to note that all plans must be reviewed by local environmental protection officials to ensure that established water quality standards will be maintained during and after development of the site and that postconstruction runoff levels are consistent with any local and regional watershed plans.
⇒ Several resources are available to assist in developing an ordinance. EPA's 2000 postconstruction model ordinance web site (*http://www.epa.gov/nps/ordinance/postcons.htm*) provides a model ordinance and examples of programs currently being implemented. In addition, the Stormwater Managers Resource Center (*http://www.stormwatercenter.net*), which was created by the Center for Watershed Protection and sponsored by the U.S. Environmental Protection Agency, provides information to storm water management program managers in Phase II communities to assist in meeting the requirements of the National Pollutant Discharge Elimination System Phase II regulations.

**Siting and Design Considerations:**
The purpose of the postconstruction ordinance is to establish storm water management requirements and controls to protect and safeguard the general health, safety, and welfare of the public residing in watersheds within a jurisdiction. The following paragraphs provide the general language and concepts that can be included in the ordinance.
⇒ *General Provisions*
This section should identify the purpose, objectives, and applicability of the ordinance. The size of the development to which post-construction runoff

controls apply varies, but many communities opt for a size limit of 5,000 square feet or more. This section can also contain a discussion of the development of a storm water design manual. This manual can include a list of acceptable storm water treatment practices and may include the specific design criteria for each storm water practice. In addition, local communities should select the minimum water quality performance standards they will require for storm water treatment practices, and place them in the design manual.

⇒ *Definitions*

It is important to define the terms that will be used throughout the ordinance to assist the reader and prevent misinterpretation.

⇒ *Permit Procedures and Requirements*

This section should identify the permit required; the application requirements, procedures, and fees; and the permit duration. The intent of the permit should ensure that no activities that disturb the land are issued permits prior to review and approval. Communities may elect to issue a storm water management permit separate from any other land development permits required, or, as in this ordinance, to tie the issuing of construction permits to the approval of a final storm water management plan.

⇒ *Waivers to Storm Water Management Requirements*

This section should discuss the process for requesting a waiver and to whom this waiver would be applicable. Alternatives such as fees or other provisions for requesting a waiver should be addressed.

⇒ *General Performance Criteria for Storm Water Management*

The performance criteria that must be met should be discussed in this section. The performance criteria can include the following:

- All sites must establish storm water practices to control the peak flow rates of storm water discharge associated with specified design storms and reduce the generation of storm water.
- New development may not discharge untreated storm water directly into a jurisdictional wetland or local waterbody without adequate treatment.
- Annual groundwater recharge rates must be maintained by promoting infiltration through the use of structural and non-structural methods.
- For new development, structural sewage treatment plants must be designed to remove a certain percentage of the average annual postdevelopment total suspended solids (TSS) load.

⇒ *Basic Storm Water Management Design Criteria*

Rather than place specific storm water design criteria into an ordinance, it is often preferable to fully detail these requirements into a storm water design manual. This approach allows specific design information to be changed over time as new information or techniques become available without requiring the formal process needed to change ordinance language. The ordinance can then require those submitting any development application to consult the current storm water design manual for the exact design criteria for the storm water management practices appropriate for their site. Topics in the manual can include minimum control requirements, site design feasibility, conveyance issues, pretreatment requirements, and maintenance agreements.

⇒ *Requirements for Storm Water Management Plan Approval*

The requirements for a storm water management plan to be approved should be addressed in this section. This can be accomplished by including a submittal checklist in the storm water design manual. A checklist is particularly beneficial because changes in submittal requirements can be made as needed without needing to revisit and later revise the original ordinance.

⇒ *Construction Inspection*

This section should include information on the notice of construction commencement, as-built plans, and landscaping and stabilization requirements.

⇒ *Maintenance and Repair of Storm Water Facilities*

Maintenance agreements, failure to maintain practices, maintenance covenants, right-of-entry for inspection, and records of installation and maintenance activities should be addressed in this section.

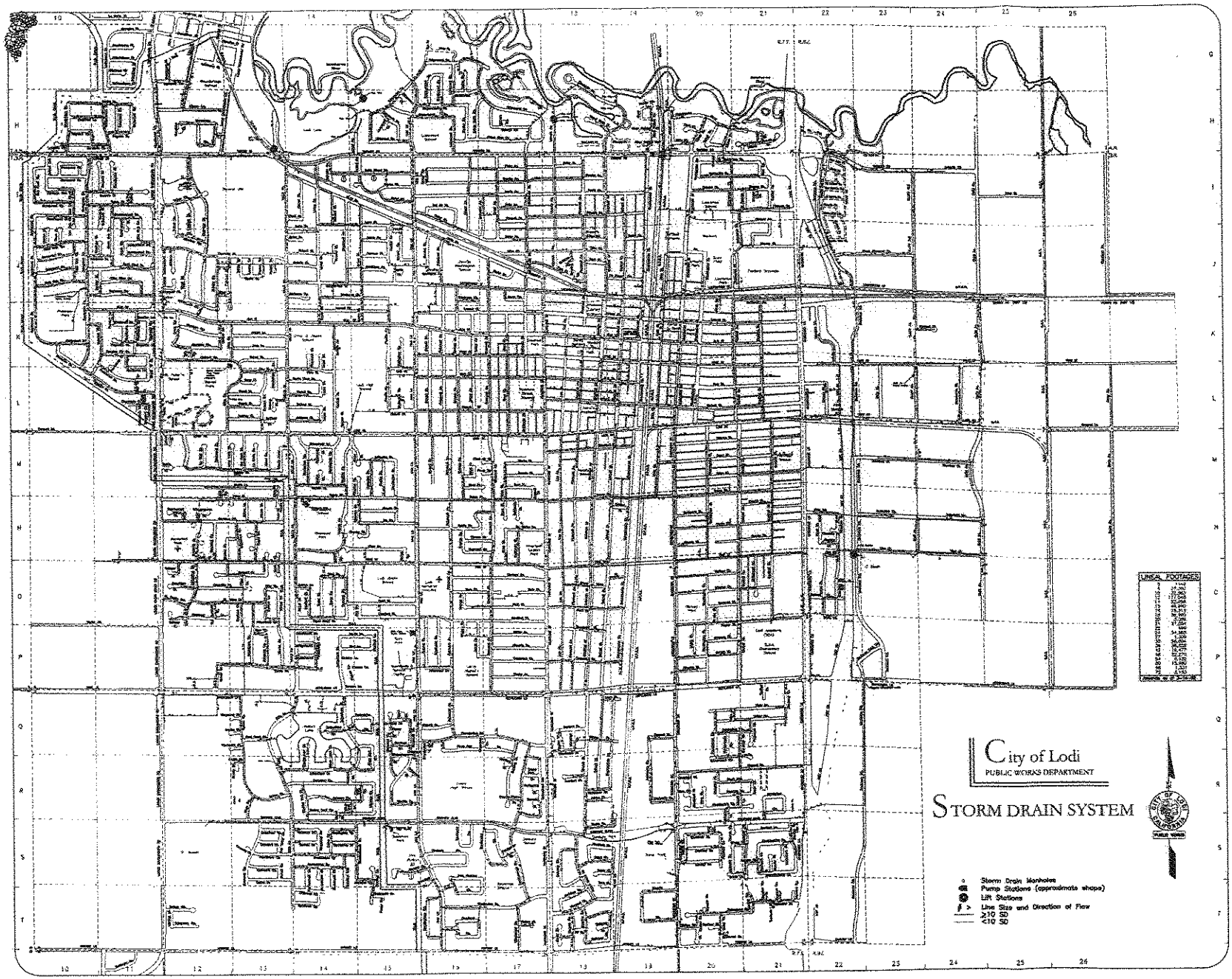
⇒ *Enforcement and Penalties*

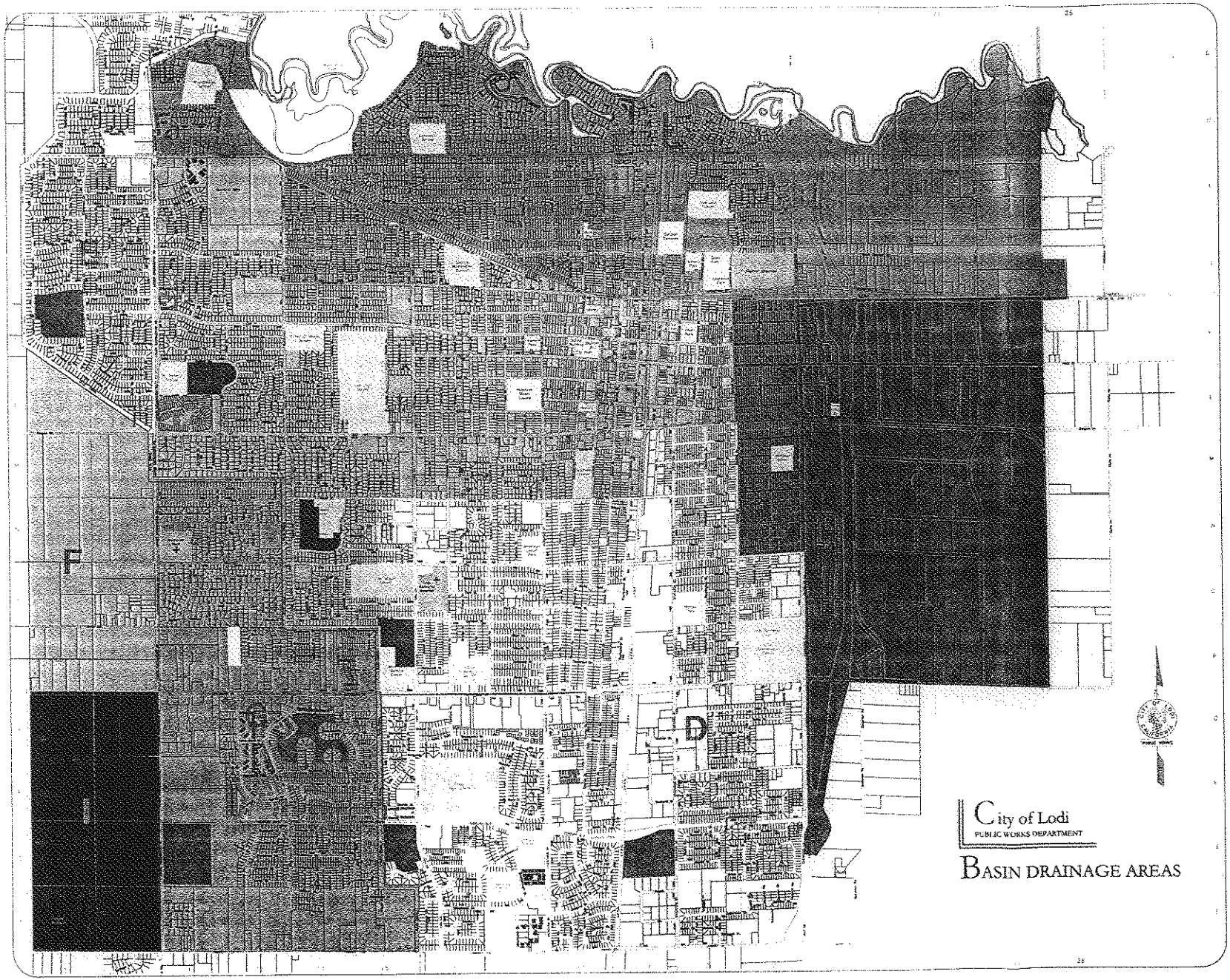
This section should include information regarding violations, notices of violation, stop work orders, and civil and criminal penalties.

**Maintenance:**

The operation and maintenance language in a storm water ordinance can ensure that designs facilitate easy maintenance and that regular maintenance activities are completed. In the "Maintenance and Repair of Storm Water Facilities" section of the ordinance, it is important to include language regarding a maintenance agreement, failure to maintain practices, maintenance covenants, right-of-entry for inspection, and records of installation and maintenance activities.

Source: EPA website. Office of Water. National Menu of Best Management Practices for Storm Water Phase II. July 1, 2002. http://www.epa.gov/npdes/menuofbmps/menu.htm


LINEAL FOOTAGES
City of Lodi
PUBLIC WORKS DEPARTMENT
STORM DRAIN SYSTEM
Storm Drain Manholes
Pump Stations (approximate shape)
Lift Stations
Line Size and Direction of Flow
≥10 SD
≤10 SD


F
L
D
City of Lodi
PUBLIC WORKS DEPARTMENT
BASIN DRAINAGE AREAS

# CITY OF LODI

**Carnegie Forum**
**305 West Pine Street, Lodi**

**NOTICE OF PUBLIC HEARING**
**Date: March 5, 2003**
**Time: 7:00 p.m.**

For information regarding this notice please contact:
**Susan J. Blackston**
**City Clerk**
**Telephone: (209) 333-6702**

NOTICE OF PUBLIC HEARING

**NOTICE IS HEREBY GIVEN** that on **Wednesday, March 5, 2003** at the hour of 7:00 p.m., or as soon thereafter as the matter may be heard, the City Council will conduct a Public Hearing at the Carnegie Forum, 305 West Pine Street, Lodi, to consider the following matter:

a) To consider adopting resolution to approve City of Lodi's Stormwater Management Program as prepared by Black & Veatch Corporation and authorizing the City Manager to approve submittal of a Notice of Intent to apply for the National Pollutant Discharge Elimination System Phase II Permit Application to the Regional Water Quality Control Board

Information regarding this item may be obtained in the office of the Public Works Department, 221 West Pine Street, Lodi, California. All interested persons are invited to present their views and comments on this matter. Written statements may be filed with the City Clerk at any time prior to the hearing scheduled herein, and oral statements may be made at said hearing.

If you challenge the subject matter in court, you may be limited to raising only those issues you or someone else raised at the Public Hearing described in this notice or in written correspondence delivered to the City Clerk, 221 West Pine Street, at or prior to the Public Hearing.

By Order of the Lodi City Council:

Susan J. Blackston
City Clerk

**Dated: February 5, 2003**

Approved as to form:

Randall A. Hays
City Attorney

***Please immediately confirm receipt of this fax by calling 333-6702***

CITY OF LODI
P. O. BOX 3006
LODI, CALIFORNIA 95241-1910

# ADVERTISING INSTRUCTIONS

**SUBJECT:** **TO SET PUBLIC HEARING FOR MARCH 5, 2003 TO CONSIDER ADOPTING A RESOLUTION TO APPROVE CITY OF LODI'S STORMWATER MANAGEMENT PROGRAM AS PREPARED BY BLACK & VEATCH CORPORATION AND AUTHORIZING THE CITY MANAGER TO APPROVE SUBMITTAL OF A NOTICE OF INTENT TO APPLY FOR THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PHASE II PERMIT APPLICATION TO THE REGIONAL WATER QUALITY CONTROL BOARD**

## LEGAL AD

**PUBLISH DATE:** **SATURDAY, FEBRUARY 8, 2003**

**TEAR SHEETS WANTED:** **Three (3) please**

**SEND AFFIDAVIT AND BILL TO:**
SUSAN BLACKSTON, CITY CLERK
City of Lodi
P.O. Box 3006
Lodi, CA 95241-1910

**DATED:** THURSDAY, FEBRUARY 6, 2003

**ORDERED BY:**

Patricia Ochoa
PATRICIA OCHOA
ADMINISTRATIVE CLERK

JACQUELINE L. TAYLOR
DEPUTY CITY CLERK

JENNIFER M. PERRIN
DEPUTY CITY CLERK

**Verify Appearance of this Legal in the Newspaper – Copy to File**

Faxed to the Sentinel at 369-1084 at 3:50 (time) on 2/6/03 (date) 2 (pages)
Kelsey Phoned to confirm receipt of all pages at (time) Jac Tricia Jen (initials)

2/6/03 Talked to Debbie will send proof in the morning PO.

forms\advins.doc

# DECLARATION OF POSTING

**NOTICE OF PUBLIC HEARING REQUEST TO CONSIDER ADOPTING RESOLUTION TO APPROVE CITY OF LODI'S STORMWATER MANAGEMENT PROGRAM AS PREPARED BY BLACK & VEATCH CORPORATION AND AUTHORIZING THE CITY MANAGER TO APPROVE SUBMITTAL OF A NOTICE OF INTENT TO APPLY FOR THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PHASE II PERMIT APPLICATION TO THE REGIONAL WATER QUALITY CONTROL BOARD**

On Wednesday, February 5, 2003 in the City of Lodi, San Joaquin County, California, a copy of the Notice of public hearing to consider a resolution establishing an area of benefit and reimbursable costs for Tienda Drive improvements (attached hereto, marked Exhibit "A") was posted at the following four locations:

Lodi Public Library
Lodi City Clerk's Office
Lodi City Hall Lobby
Lodi Carnegie Forum

I declare under penalty of perjury that the foregoing is true and correct.

Executed on February 6, 2003 at Lodi, California.

ORDERED BY:

**SUSAN J. BLACKSTON**
**CITY CLERK**

Jacqueline L. Taylor
Deputy City Clerk

Patricia Ochoa
Administrative Clerk

Jennifer M. Perrin
Deputy City Clerk

forms\decpost.doc

# DECLARATION OF MAILING

**PUBLIC HEARING TO CONSIDER ADOPTING RESOLUTION TO APPROVE CITY OF LODI'S STORMWATER MANAGEMENT PROGRAM AS PREPARED BY BLACK & VEATCH CORPORATION AND AUTHORIZING THE CITY MANAGER TO APPROVE SUBMITTAL OF A NOTICE OF INTENT TO APPLY FOR THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PHASE II PERMIT APPLICATION TO THE REGIONAL WATER QUALITY CONTROL BOARD**

On February 6, 2003 in the City of Lodi, San Joaquin County, California, I deposited in the United States mail, envelopes with first-class postage prepaid thereon, containing a letter regarding to consider adopting resolution to approve City of Lodi's Stormwater Management Program as prepared by Black & Veatch Corporation and authorizing the City Manager to approve submittal of a Notice of Intent to apply for the National Pollutant Discharge Elimination System Phase II Permit Application to the Regional Water Quality Control Boadrd, marked Exhibit "A"; said envelopes were addressed as is more particularly shown on Exhibit "B" attached hereto.

There is a regular daily communication by mail between the City of Lodi, California, and the places to which said envelopes were addressed.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on February 6, 2003, at Lodi, California.

ORDERED BY:

**SUSAN BLACKSTON**
**CITY CLERK, CITY OF LODI**

**ORDERED BY:**

JACQUELINE L. TAYLOR
DEPUTY CITY CLERK

JENNIFER M. PERRIN
DEPUTY CITY CLERK

PATRICIA OCHOA
ADMINISTRATIVE CLERK

Forms/decmail.doc

# DECLARATION OF MAILING
# LETTER TO APPELLANT

**PUBLIC HEARING TO CONSIDER ADOPTING A RESOLUTION TO APPROVE CITY OF LODI'S STORMWATER MANAGEMENT PROGRAM AS PREPARED BY BLACK & VEATCH CORPORATION AND AUTHORIZING THE CITY MANAGER TO APPROVE SUBMITTAL OF A NOTICE OF INTENT TO APPLY FOR THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PHASE II PERMIT APPLICATION TO THE REGIONAL WATER QUALITY CONTROL BOARD**

On February 6, 2003, in the City of Lodi, San Joaquin County, California, I deposited in the United States mail, envelopes with first-class postage prepaid containing a letter of notification, a copy of which is attached hereto, marked Exhibit "A"; said envelopes were addressed as is more particularly shown on Exhibit "B" attached hereto.

There is a regular daily communication by mail between the City of Lodi, California, and the places to which said envelopes were addressed.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on February 6, 2003, at Lodi, California.

ORDERED BY:

**SUSAN BLACKSTON**
**CITY CLERK, CITY OF LODI**

**ORDERED BY:**

JACQUELINE L. TAYLOR
DEPUTY CITY CLERK

JENNIFER M. PERRIN
DEPUTY CITY CLERK

Patricia Ochoa

PATRICIA OCHOA
ADMINISTRATIVE CLERK

| NAME | ADDRESS |
|---|---|
| A. FRED BAKER | PO BOX 1510<br>LODI CA 95241-1510 |
| EDWARD BARKETT<br>ATLAS PROPERTIES INC | 2800 W MARCH LN STE 250<br>STOCKTON CA 95219-8218 |
| DELMAR BATCH | PO BOX 1597<br>LODI CA 95241 |
| DENNIS BENNETT<br>BENNETT DEVELOPMENT | 777 S HAM LN<br>LODI CA 95242 |
| BROWMAN DEVELOPMENT | 100 SWAN WY STE 206<br>OAKLAND CA 94621 |
| STEVE SINNOCK<br>KJELDSEN SINNOCK & NEUDECK | PO BOX 844<br>STOCKTON CA 95201-0844 |
| CECIL DILLON<br>DILLON & MURPHY ENGINEERING | PO BOX 2180<br>LODI CA 95241-2180 |
| DALE GILLESPIE<br>GEWEKE PROPERTIES | PO BOX 1210<br>LODI CA 95241 |
| LOWELL FLEMMER<br>KATZAKIAN WILLIAMS SHERMAN | 777 S HAM LN STE A<br>LODI CA 95242 |
| JOHN GIANNONI<br>GIANNONI DEVELOPMENT | 1500 W EL CAMINO AVE STE 192<br>SACRAMENTO CA 95833 |
| TONY GOEHRING | ADMINISTRATION – CITY HALL |
| STEVE ROBERTS<br>HARRIS & ASSOCIATES | 35 E 10TH ST STE A<br>TRACY CA 95376 |
| RANDALL HAYS<br>CITY ATTORNEY | ADMINISTRATION – CITY HALL |
| JEFFREY KIRST<br>TOKAY DEVELOPMENT INC | PO BOX 1259<br>WOODBRIDGE CA 95258 |
| MAMIE STARR<br>LUSD | 1305 E VINE ST<br>LODI CA 95240 |
| TERRY PIAZZA & STEVE PECHIN<br>BAUMBACH 7 PIAZZA | 323 W ELM ST<br>LODI CA 95240 |
| DARRELL SASAKI<br>DRS REAL ESTATE APPRAISALS INC | 1806 W KETTLEMAN LN STE 1<br>LODI CA 95242 |
| RON THOMAS<br>R THOMAS DEVELOPMENT INC | PO BOX 1598<br>LODI CA 95241-1598 |
| LEX CORALES<br>SIEGFRIED & ASSOCIATES | 4045 CORONADO AVE<br>STOCKTON CA 95204 |
| WENTLAND SNIDER MCINTOSH | 301 S HAM LN STE A<br>LODI CA 95242 |
| LWM SOUTHWEST INC | PO BOX 414<br>PACIFIC PALISADES CA 90272 |
| TOM DOUCETTE<br>FRONTIERS | 3247 W MARCH LN STE 220<br>STOCKTON CA 95219 |
| RUSS MUNSON<br>WINE & ROSES | 2505 W TURNER RD<br>LODI CA 95242 |
| TOM DAVIS<br>LEE & ASSOCIATES | 241 FRANK WEST CIR STE 300<br>STOCKTON CA 95206 |
| GREGORY OLEARY<br>COLLIERS INTERNATIONAL | 4609 QUAIL LAKES DR STE 3<br>STOCKTON CA 95207 |

| | |
|---|---|
| MICHAEL E LOCKE CEO<br>SAN JOAQUIN PARTNERSHIP | 2800 W MARCH LN STE 470<br>STOCKTON CA 95219 |
| WILLIAM T MITCHELL<br>THE MITCHELL GROUP | 1801 OAKLAND BLVD STE 210<br>WALNUT CREEK CA 94596 |
| CHUCK EASTERLING<br>HESSELTINE REALTY | 222 W LOCKEFORD ST STE 3<br>LODI CA 95240 |
| BOB ANDOSCA<br>LODI DISTRICT CHAMBER OF COMMERCE | 35 S SCHOOL ST<br>LODI CA 95240 |
| DR CHRIS KESZLER | 816 W LODI AVE<br>LODI CA 95240 |
| SEAN CRAWFORD<br>PACIFIC BELL | 2300 EIGHT MILE ROAD<br>STOCKTON CA 95210 |
| MARK CHANDLER EXEC DIRECTOR<br>LODI WOODBRIDGE WINEGRAPE COMMISSION | 2575 W TURNER RD<br>LODI CA 95242 |
| KEN SHARRAR<br>BUILDING INDUSTRY ASSN OF THE DELTA | 1150 W ROBINHOOD DR STE 4C<br>STOCKTON CA 95207 |
| JOHN COSTAMAGNA<br>JC CUSTOM HOMES | PO BOX 131<br>WOODBRIDGE CA 95258 |
| RAINFORTH-GRAU ARCHITECTS | 3250 RAMOS CIR<br>SACRAMENTO CA 95827 |
| MITCH FLETCHER<br>FLETCHER DEVELOPMENT | 3046 CUMBRIA CT<br>LODI CA 95242 |
| TROY WRIGHT<br>DAVID EVANS & ASSOCIATES | 5311 PIRRONE RD STE B<br>SALIDA CA 95368 |
| TOM PHILLIPPI<br>PHILLIPPI ENGINEERING | PO BOX 6556<br>VACAVILLE CA 95696 |
| BOB WARREN<br>WARREN-GREEN ENGINEERING | 3114 BRENNANS RD<br>LOOMIS CA 95650 |
| VOSS CIVIL ENGINEERS | 6810 DI LUSSO DR NO L345<br>ELK GROVE CA 95758 |
| CORDOBA GIERVIN SCHWEITZER ARCHITECTS | 444 N 3RD ST STE 301<br>SACRAMENTO CA 95814 |
| AM STEPHENS CONSTRUCTION | PO BOX 1867<br>LODI CA 95241 |
| ALLEN & SONS CONSTRUCTION | 6001 S EL DORADO ST<br>STOCKTON CA 95206 |
| G & L BROCK CONSTRUCTION | 4145 CALLOWAY CT<br>STOCKTON CA 95215 |
| CRUTCHFIELD CONSTRUCTION | 2655 E MINER AVE<br>STOCKTON CA 95205 |
| DELTA KEEPER | 3536 RAINER AVE<br>STOCKTON CA 95203 |
| DERIVI-CASTELLANOS ARCHITECTS | 946 N YOSEMITE<br>STOCKTON CA 95203 |
| DSS COMPANY | 655 W CLAY ST<br>STOCKTON CA 95206 |
| POPUCH CONSTRUCTION | 11450 N PEARSON RD |

| | |
|---|---|
| | LODI CA 95240 |
| TEICHERT CONSTRUCTION | 265 VAL DERVIN PRKWY<br>STOCKTON CA 95206 |
| DIEDE CONSTRUCTION | PO BOX 1007<br>WOODBRIDGE CA 95258 |
| F & H CONSTRUCTION | 4945 E WATERLOO RD<br>STOCKTON CA 95215 |
| DAVE WILLIAMS & ASSOCIATES | 1213 W LOCKEFORD ST<br>LODI CA 95242 |
| MIKE SMITH ENGINEERING | PO BOX 611<br>LODI CA 95241 |
| BROWMAN DEVELOPMENT | 100 SWAN WY STE 206<br>OAKLAND CA 94621 |
| DELMAR BATCH | 111174 N DAVIS RD<br>LODI CA 95242 |
| SUNRISE DEVELOPMENT | PO BOX 131<br>WOODBRIDGE CA 95258 |
| CITY OF LODI POLICE DEPT | |
| KATHY GRANT<br>PUBLIC WORKS – MSC | |